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IN INDIA AND THE EAST

Seventh Indian Edition

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PROFITABLE POULTRY KEEPING IN INDIA AND THE EAST

A Complete Guide to Breeding and Keeping
Poultry for Eggs or for the Table, with
Practical Hints on Diseases

By
A. C. CAMPBELL-ROGERS



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P R E F A C E

SUCCESSFUL large scale poultry farming is largely a matter of temperament. Anyone who has no sympathy or understanding of animals and birds is very unlikely to make a success of it. Poultry farming entails a very great deal of hard and unrelenting routine work which may become very monotonous for those who are disinclined to undertake the same tasks every day without any hope of a break or holiday. Success is a matter of cool decisions, without constant hovering and changing of the mind; acute observation, initiative, and unremitting attention to a vast amount of petty details. A successful poultry farmer must be prepared to get up early—every morning of his life—and work hard all day at a large variety of various jobs, each of which requires close attention and cool judgment. Account must be kept of every anna spent or received and records made of the laying and pedigree of every bird, chick and adult. If the aspiring poultry farmer is not prepared to do all these things—and keep on doing them—he may as well employ himself in some other line of business. Anyone who has been accustomed to carrying out routine orders without using his own initiative is not likely to make a good poultry farmer, because success depends on initiative and self-reliance.

Small scale poultry farming—indulged in as a spare time occupation—is a different matter. Failure under these conditions does not involve bankruptcy, but mere disappointment combined with a certain amount of loss not amounting to a major disaster. In any case, on whatever scale it is decided to start on—except backyard poultry keeping which is as safe as any poultry keeping can be—the beginner is advised to commence on a scale well within his means and, if possible, learn the rudiments of his craft at some Government Poultry Institution before commencing on his own. Perhaps the best way to begin is to buy from the Institute which he knows half a dozen pullets just about to commence laying and a pedigree cock from a guaranteed strain of good egg-producers. When one of his hens goes broody he can then hatch a dozen or so of his own eggs and go through the whole process from chick to laying pullet on a very modest scale, making a small profit out of the eggs laid from the

PREFACE

very first while he is gaining experience and making his initial—and inevitable—mistakes. If he refuses to lose a whole year in making mistakes and gaining experience on a small scale he will merely gain the same—or more unhappy—experience on a much larger scale and at a very much greater expense, which may prove ruinous and disgust him with poultry farming for the rest of his life. The best places to start poultry farming in India are Hill Stations and other cool places where lice and other parasites are not such an everlasting menace and nuisance.

My final warning is: do not keep more fowls than you can house adequately without any risk of overcrowding, insist on adequate runs covered with short fresh grass and bushes, which have not been used previously for poultry keeping, and have sufficient spare space to utilize all your resources, such as fowl's manure, to the utmost. Given the necessary space, your fowls will produce sufficient excellent manure to grow a sizeable patch of vegetables as well as green food for their own consumption. Mustard is an excellent fast growing and hardy plant for chicken feed; it should be used when it is not much more than a foot high. If you combine dairy farming with poultry keeping you will have a useful and profitable method of using skim milk or buttermilk always at hand, and the extra manure will enable you to grow more vegetables and fruit without any extra expense.

It must not be concluded that poultry keeping on a modest scale, say two or three hundred birds, can be expanded to a farm on which as many thousands are kept with the same gratifying results. As numbers increase, so do difficulties multiply, and any increase should be achieved gradually, step by step. Consolidate the position at one stage before the next is attempted. It is only by gradual progress from the less to the greater that final larger scale success can be assured. There is a very good Provencal proverb which is appropriate to the budding poultry farmer. It runs, "he who goes slowly goes sensibly; and he who goes sensibly goes a long way." This is a very good saying to keep in mind, during moments of exuberant enthusiasm.

A. C. C. R.

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CHAPTER I

GENERAL PRINCIPLES

THERE can be very little doubt that poultry keeping in India on a small scale, provided it is conducted on the right lines from the first, can be a pleasant and profitable business, especially at the present moment when there is an acute food shortage and the prices of both eggs and poultry have rocketed sky-high. A couple of dozen hens will supply all the eggs that any small household needs and will also furnish an occasional chicken for the pot. However, there is a limit, at the present time, to this potential profitableness. Most families have sufficient surplus food and food scraps to feed a few hens. The number will naturally depend on the size of the family. Where all, or very nearly all, the hens can be fed on waste from the family table poultry keeping will be undoubtedly profitable as there will be little or no cost for food. When the number kept is so large that the greater part of the food they consume has to be bought the cost of feeding may very well exceed the value of the eggs supplied. This will specially be the case where the hens are poor egg producers and great care must be taken, not only in selecting an appropriate breed but in getting a high egg-laying strain in that breed. This is not so easy as it sounds, specially in India where the breeding of poultry has not been carried to such a high pitch of perfection as it has been in England and America.

I doubt very much whether really large scale poultry keeping in India will ever be a paying proposition, for many reasons. Firstly, on account of the high cost of installing a really well-equipped poultry farm. Before the war it was calculated that the cost of buying suitable land and equipping it fully with the necessary buildings, water supply, light, and apparatus such as incubators, brooders, trap nests and the other multitudinous fittings of an up-to-date and fully equipped poultry farm and purchase of initial stock of hens would amount to about £10 per bird. Secondly, on account

of the fact that no ready mixed poultry foods are manufactured in this country it would either be necessary to import these foods, at a prohibitive cost, or mix them on the farm. It is more than likely that the necessary grains would either not be available at all or only available in very limited quantities and in irregular amounts, at still more irregular intervals. Thirdly, in a hot climate like that of India the parasites of poultry increase at an alarming rate when it is kept in large numbers on a limited space of ground. There is therefore a constant war against these vermin and the cost of keeping them under control may very easily run away with all the profits of the enterprise. Fourthly, there is the question of disease to consider. Most diseases of poultry come as practically uncontrollable epidemics which make a clean sweep of the whole flock, in the case of fowls, before anything can be done about it. These epidemics leave the whole occupied area infected so that as well as losing his whole stock of valuable pedigree birds the unfortunate poultry farmer is faced with the formidable task of disinfecting the whole of his buildings and even the land before he can venture to restock his farm.

For these reasons the prospective large scale poultry farmer will be well advised to weigh the disadvantages and difficulties carefully before venturing his capital in such a risky business. On many occasions circumstances may be entirely beyond the poultry fancier's control, however careful and hygienic he may be. An epidemic may spread from village hens and sweep away the whole flock of his birds in spite of every precaution on his part, and these epidemics among country fowls are of very frequent occurrence. The germs of these epidemic diseases are just as easily carried on the feet and clothing of visitors and employees as by the birds themselves.

With small scale domestic poultry keeping the task of keeping down vermin is not so formidable, although still difficult, and the cost of hygienic precautions is not so great, nor are they so difficult to apply as they are on a large scale. The birds will not be so crowded on the available land and therefore not so likely to pick up infections. In the case of an epidemic carrying off the whole flock the loss will be comparatively trifling and in any case will not jeopardise the

livelihood of the owner, although it may make him (or her) a poorer and a wiser, individual.

Many books on poultry keeping advise plants and buildings on a scale totally beyond the means of the average poultry keeper in India. American books especially err in this manner. They advise the installation of water systems and electric appliances which are not available even to human beings in most parts of India and, in any case, totally beyond the reach of people of moderate means. It is the purpose of this book to avoid suggesting methods which are impracticable on account of their expense or on account of the fact that the apparatus recommended will have to be imported either from England or America. Suggestions will be made for the improvisation of apparatus from materials which are available everywhere, with the exception of incubators, the making of which is beyond the ability of the average individual and requires a considerable number of wood and metal working tools. The remainder of the suggested plant and buildings can be made by any *maistry* of average intelligence, or even by the poultry farmer himself if he has some experience in the use of carpenter's tools.

The essentials of successful poultry farming on a small scale are as follows and each item will be fully explained in future chapters.

1. Suitable locality.
2. The correct breed and strain for the purpose aimed at.
3. Proper housing.
4. Correct hygiene.
5. Control of vermin.
6. The control of disease.

There will also be chapters on the best and most economical way to start, the management of sitting hens, use of incubators and brooders, the feeding and management of young chickens, feeding of the flock, arrangements for laying hens, segregation of cockerels, building of poultry houses, making of water troughs, feed hoppers and miscellaneous apparatus. Care will be taken not to suggest expensive imported apparatus which is either too expensive to be practicable or not obtainable in India anyhow. The same applies

to feeding stuffs. However, there are certain essentials without which poultry keeping anywhere is not likely to be successful. They are: adequate space, the availability of sufficient green food and initial freedom from disease of the ground selected.

Where space is restricted or poultry disease rampant it would be better not to attempt to keep hens, but to be content with ducks which can be kept in a restricted space, go on laying for several years, and are much less liable to disease. One of the disadvantages of keeping fowls is that they only lay for two seasons and after that have to be fattened and sold or used for the table. Hence the need for a high egg-producing strain as a hen which only lays about a couple of dozen eggs per year is hardly worth the trouble of keeping. However, it must be recollected that ducks are much noisier than hens, unless Muscovy ducks are kept; but the latter lay very few eggs although they are highly ornamental and the best of all poultry for the table. If ducks are kept merely for egg production and not for breeding purposes there is no need for water for them to swim about in. It is, of course, better to have a pond or at least a sunken tub for them to use as it enables them to keep themselves clean. But this is not absolutely necessary unless you intend to keep the eggs for setting purposes. In that case ducks must have a small expanse of water to swim about in because the drakes couple with the ducks on the water and cannot do so on land. The same applies to geese.

Turkeys are difficult to rear in the chick stage and are not really hardy until they "shoot the red," which is the technical expression for the acquisition of their red combs and wattles. When they grow big enough to look after themselves they require a wide range and large houses and are also liable to "lay wild," which means that they nest in well-concealed places far away from their usual accommodation and their nests are then very difficult to find. They may lay their eggs and hatch their chicks in the nearest patch of jungle where they are very liable to be killed and eaten by jackals or wild dogs, or stolen. Provided turkeys have a large garden or orchard to range in, from which it is difficult or impossible for them to stray, they are very economical birds to keep because they can find for

themselves most of the food they need and will keep the land they range over free from grasshoppers and other insect pests. Turkeys also should not be kept with hens because they are liable to kill small chickens even if they do not actually eat them, and the mothers of the chickens are not capable of driving off the turkeys on account of their much greater size and strength. All these matters are mentioned because they must be taken into consideration when deciding on what kind of birds to keep and whether it is desired to keep different kinds of poultry together. Theft has always to be taken into consideration and is probably one of the most important causes of loss to the Indian poultry keeper. Wandering gypsies are always on the lookout for succulent hens and are also very expert in stealing them without making enough noise to warn the owner. Good dogs are useful here and, curious as it may seem, geese are even better watch-dogs than the four-footed kind. They can always be depended upon to give timely warning of danger of thieves and they are also exceptionally intelligent and affectionate birds which need very little looking after provided that they have plenty of fresh green grass to feed on.

Jackals, hungry pariah dogs, the mongoose, jungle cats, and in some places foxes, also play havoc with poultry and have to be incessantly guarded against. Here again good house-dogs are your best protection and care in shutting your hens carefully into their houses every night. I once lost five magnificent imported Rhode Island Red cocks through a coolie carelessly leaving the fowlhouse door open one night. A jungle cat got into the house in which they were and killed all five before I could get to the spot. One of my dogs killed the cat but not until my five cocks were dead, which was no satisfaction to me. However, the dogs soon go to know all about jungle cats and chased them into trees and kept them there until my attention was attracted by their barking and I was able to shoot them. Any poultry keeper who shuts his flock into well constructed houses carefully every night and keeps three or four intelligent and well-trained dogs has nothing much to fear from cats, jackals, or roving human beings, but he must be quick with his gun if he lives in the country.

And here we come to another very important point: order and system. If anyone imagines he is going to be a successful poultry farmer, or even a poultry keeper on a small scale, by doing things in a haphazard and slapdash manner, without order and system, he (or she) is very grievously mistaken. The domestic fowl is a temperamental bird and reacts very strongly to neglect or the reverse. If you wish your hens to lay regularly and abundantly you must feed them regularly and abundantly and see that they lead a quiet, peaceful, and well-ordered life. If they are chased about, frightened, or neglected, they will forthwith cease to lay; but if they get their food and drink regularly and in ample quantities at stated times every day, are well housed, kept dry and clear of vermin, and free from disease, they will be a constant source of profit and satisfaction to their owner. But all these things cannot be achieved without knowledge and constant personal attention to detail, and a systematic and orderly way of doing everything needful. In this book I shall be careful to explain how an orderly system of feeding and management is to be achieved.

Every poultry keeper who wishes to make a success of his undertaking should regularly subscribe to one or two first-class poultry journals. As far as I know there is no such journal published in India so recourse must be had to one published in either England or America. As American journals deal mostly with conditions in a very cold climate where fowls are kept under cover during the whole of a very long winter and sometimes all the year round, American poultry journals do not help the Indian poultry keeper very much, and so I recommend English magazines which would deal with conditions in a much milder climate in which hens are kept more in the open as they are in India. The reader of a poultry journal will have the advantage of seeing advertisements of a large variety of incubators, brooders, and other poultry appliances which, even if he has no intention of importing them, will interest him and give him a lot of very useful information, enabling him to improvise similar but more simple apparatus for himself, possibly with the assistance of the local carpenter and tinsmith. A little ingenuity goes a long way in fixing up the necessary plant. Another piece of valuable information he will glean from a poultry

journal is the latest advances in the breeding of high egg-laying strains and the firms from which he can import the initial stock he may need if he decides to buy out of India.

Finally, although I consider large scale poultry farming in India a very risky business for reasons which I have mentioned above, I shall devote some space to describing how a large scale poultry farm may be started in the most economical manner and with a minimum of buildings and expensive imported plant. Of course, this cannot be done without any imported apparatus at all because incubators are not as yet being manufactured in this country.

CHAPTER II

ELEMENTARY GENETICS

ANYONE who does not like the look of the heading of this chapter may leave it out and get on with the rest of the book. But as the art of poultry breeding is founded on the science of genetics the enthusiastic poultry breeder will not make much progress until he takes the trouble to acquire at least an elementary knowledge of genetics on which the whole success of animal breeding depends. Many hefty and decidedly difficult tomes have been written on applied genetics and to obtain the information given in this one short chapter the would-be student of genetics might have to read several exceedingly tough and expensive books, most of which he would probably fail to understand, as I did when I first began to study the subject. But the subject is one of absorbing interest and well worth digesting because it applies just as much to human beings as it does to animals and birds. Anyone wishing to pursue the subject further—and all are advised to do so—cannot do better than to consult the books mentioned at the end of this chapter.

As far as possible I shall treat the subject in the simplest possible manner, confining myself purely to its practical applications, using the irreducible minimum of technical terms, with which the science of genetics is profusely supplied, and explaining those used in the text as I go along. It is just as well for the prospective poultry keeper to get on familiar terms with these technicalities as soon as possible because they will soon be cropping up in his future reading, where they will probably not be explained. By learning something about genetics the poultry keeper will understand a great many things which might otherwise puzzle him greatly, and by understanding why things have gone wrong he will be able to put them right instead of wasting time in blaming his birds or the people who sold them to him.

The study of elementary genetics may help him to understand the difficulties, uncertainties, and expense incidental to the breeding of high production strains of pedigree poultry and the reason for the high prices demanded for guaranteed birds. It will also help him to realize that once he has invested in a breeding stock of high class cocks and hens he must be very careful to pair them correctly if he is not to risk losing the whole benefit of this expenditure within a generation or two. And this is much more easily done than most people imagine and through no fault of the poultry either.

"GENETICS" SIMPLY EXPLAINED.—All living things, whether they are plants, birds, reptiles, or higher animals including man, develop from the union of two single minute reproductive cells, the female cell generally being about one twenty-fifth of an inch in diameter or less. The male reproductive cell, or sperm, is a good deal smaller than the female cell, which is called an ovum (Latin for egg, plural ova). This may seem the purest nonsense to some people who know perfectly well that a hen's egg is vastly larger than the size mentioned and that the egg of an ostrich is even larger still. However, the eggs of birds and reptiles are a special case because these large eggs consist almost entirely of the yolk which contains all the nourishment necessary for the development of the nucleus (or ovum), which is actually of the size stated, right up to the stage of the fully developed chick ready to start its independent existence, without the necessity for any supplementary nourishment. Whereas in nearly all warm blooded animals, the minute ovum remains attached to the tissues within its mother's uterus (womb) from which it obtains all the nourishment necessary for its full development.

In the case of fowls, the nucleus (as it is usually called) is attached to the outer membrane of the yolk and as soon as warmth is applied to the outside of the eggshell by the hen's body, which has a temperature of from 103 to 104 degrees F, this nucleus immediately begins to develop and absorb nourishment from the yolk to which it is attached. The first sign of growth is the development of a dark spot, representing the developing ovum, which is surrounded by a

series of small blood vessels radiating from it. By holding a developing egg between the eye and a strong light this small dark spot can be seen and is a sign that the egg is fertile and has begun to develop. If after a week the contents of the egg are clear and show no signs of a dark spot it is a sign that the egg is infertile and will never develop into a chicken. This kind of egg should be discarded and another substituted if possible.

Thus, the contents of the egg are gradually absorbed by the nucleus, or fertilized ovum, until they have been gradually built up into all the organs, tissues, and feathers of the perfect chick. When the chicken finally emerges from the eggshell sufficient yolk still remains in the little creature's stomach to provide all the sustenance necessary for at least twenty-four hours, although drinking water is necessary from the very first hour. The significance of this fact is that little chickens, newly hatched, can do without food for a whole day while they get used to their new surroundings. This very convenient circumstance is made use of in the day-old chick trade to send batches of newly hatched chicks through the post, in specially designed boxes, either by air or by train. They come to no harm because they need no food anyway, whether travelling or not. There are two very important points to be noticed here. First, that the chicken is not developed from the whole egg, but from a single fertilized cell, which forms only an infinitely minute part of the whole contents within the eggshell, and is in fact only barely visible to the naked eye. The fact that you have a dozen eggs therefore does not necessarily imply that you are going to hatch a dozen chickens by putting them under a broody hen. To produce a chick each egg must contain a *fertilized* ovum. Secondly, the nucleus from which the chick is developed should consist of a female ovum which has been fertilized by a male reproductive cell, or sperm. The latter contributes just as much to the development of the chicken as the female cell does. In fact, without this male sperm within the ovum the development of a chicken is impossible however large and healthy the egg may seem. All hen's eggs are not necessarily fertile. Hens lay just as many eggs whether a cock is running with them or not, so in order to get a full quota of chickens from a certain number of eggs

they must all be fertile.

You will notice that in writing of the development of the chick I have always referred to the *fertilized* cell. Hens can, and do lay eggs which contain only the unfertilized female half of the reproductive cell, derived solely from their own ovaries, from which no chick can develop because they do not contain the sperm derived from the male, and are therefore infertile. However, from every point of view, except that of obtaining chickens, these are perfectly good eggs and, in fact, keep much better than fertile ones. Fertile eggs are only produced when cocks and hens run together and have opportunities for mating. As both cock and hen contribute equally to the fertilized ovum (which is called a zygote) the hereditary characteristics of the resulting chicken depend equally upon the factors contributed by each parent, the chick being a mixture of the qualities of its parents, some good, some bad. The significance of this will be explained next.

BREED AND STRAIN.—A breed is a collection of individuals within a species which has been evolved by selective mating for some definite set of qualities, such as striking appearance, resistance to disease, high fertility, or other characteristics. Breeds are nearly always of uniform appearance. A strain is a special group of individuals, within a breed, in which certain desirable qualities, such as high egg production, early maturity, etc., have been fixed by equally careful selective mating but generally without interfering with the outward appearance of the breed selected for improvement. This, of course, is not invariably the case but is generally speaking correct. It is therefore impossible to determine by mere inspection what particular qualities a special strain may possess. Thus, generally White Leghorns may be better egg producers than other breeds; but White Leghorns, taken as a breed, may not be capable of laying more than 100 to 150 eggs in their first egg-laying season. However, by very careful selection of known good egg producers, both male and female, and by mating them together it is possible to produce *strains* of White Leghorns, or other colours for that matter, capable of producing 200, 250, or even 300 eggs in their first season, although these birds may

be indistinguishable in appearance from the average White Leghorn. The only way in which the desirable qualities of a particular strain can be distinguished is by trial. Therefore the only way to be certain that you are getting what you pay for when buying high egg-producing strains is to deal with firms which are thoroughly reliable and have a reputation to maintain.

For the highest egg production it is not sufficient to buy merely a breed noted generally for the large number of eggs which it lays; you must also ensure that you are getting a high production strain within that breed. As both the cock and the hen contribute equally to the hereditary qualities of the chick, such as fine plumage, resistance to disease, or high egg production, it is important that both cock and hen should come from a pedigree high production strain. If possible the cock and the hen should be unrelated or not closely related, although most strains are considerably in-bred. If you breed a high production cock to merely average hens, although those hens may be pure bred, you will certainly get a few more eggs per hen in the first generation than you would get from nondescript stock, but you will not get nearly as many eggs as you would from cocks and hens which are both guaranteed to be from a high production strain. In other words, in order to obtain the best results your cocks and hens must both be of equal quality from the egg production point of view. By introducing only one indifferent cock you are liable to ruin the egg production of your whole flock of layers as time goes on and the progeny of the poor cock begin to mate with the offspring of the high egg layers. One indifferent cock can do more damage in a short space of time than several poor hens because the very first batch of eggs from the hens will show their poor egg laying qualities but with a cock it is not until his offspring have *mated* with the others that his indifferent quality will be noticed in his offspring and by that time a very large number of poor layers will have been bred and will have to be eliminated to bring the flock back to a high average production. Constant vigilance is therefore necessary if high production is to be maintained, coupled with ruthless culling (elimination) of poor layers from the breeding pens. All cocks must be tested for their capacity to transmit high egg laying capa-

city before they are used for breeding purposes.

We must now enquire how high egg producing strains are produced and why they are high egg producers. In order to do this I shall have to explain the mechanism of fertilization. Fertilized ova, you will remember I said that ova are the unfertilized cells of the female, are formed by the union of one male cell, the sperm, with one female cell, the ovum. In the act of fertilization one sperm penetrates the outside membrane of the ovum and the contents of the sperm unites with the contents of the ovum to form a fully fertilized reproductive cell, a zygote. After the sperm has entered the ovum the membrane of the ovum becomes impermeable to other sperms so only one sperm ever gets into an ovum. This fertilization takes place within the genital tract of the female during or after the act of copulation. Hence, to produce fertile ova both a male and female are required, and no fertile eggs, no chickens. However, for infertile eggs this is not necessary and hens will lay just as many eggs whether there is a cock in the flock or not. So for egg-production pure and simple no cocks are necessary. I have emphasized this point because a great many people seem to think that eggs without cocks are an impossibility.

We must now examine the mechanism by which hereditary characteristics are passed on from parent to offspring, which will help to explain why high production strains are produced. Each reproductive cell is furnished with a set of chromosomes, as well as some other things which do not concern us, and these chromosomes are built up of genes, which have been found by innumerable experiment to be the carriers of hereditary characteristics. The chromosomes are long string-like filaments of different shapes on which the genes seem to be strung like a row of beads. This is, of course, a very primitive description but sufficient for our purpose. When the sperms and the ova are formed in the gonads (the genital organs) the gonadal cells divide in a special manner and in such a way that each new cell contains only half the chromosomes which are normal for a somatic cell (ordinary body cell, from the Greek word *soma*, body). When a sperm unites with an ovum to form a zygote (a fully fertilized reproductive cell or egg) the chromosomes

from the sperm and the ovum unite. You will recollect that I told you a sperm and an ovum only contain half the normal number of chromosomes, so that the resulting zygote contains the full number of chromosomes which is specific for the particular species being considered. In this case fowls. The cells of each species contain a number of chromosomes particular to that species, the higher animals generally having more chromosomes than the lower. As it is the genes in the chromosomes which carry hereditary characteristics it will be seen that the male contributes a full half of these and the female the other full half, so that hereditary factors come as to one half from the male and one half from the female. It is of no practical use therefore to breed a high grade strain of poultry with a low grade if the object is to obtain the full maximum of egg production, even if both are pure bred birds of the same breed. The special characteristics of heredity are concerned with individuals and not with the species as a whole. Although the general qualities of a species are the average of all the qualities of the individuals of that species, these characteristics are not equally distributed and some individuals may be good, some bad, and some indifferent. However, taking one particular characteristic, egg laying for instance, the average of all individuals may be higher than the average of some other breed within the same species. This is the case with White Leghorns. They lay on an average more eggs than most other breeds. But the average unselected White Leghorn will not lay as many eggs as a specially selected strain of some other breed which has been bred for high egg laying. But again a specially selected strain of White Leghorns would probably exceed the specially selected strain of the other breed in the number of eggs laid. It will be understood that strain is even more important than breed when it is put to the test of maximum production.

It is the genes, of which the chromosomes are built up, as it were, that carry the factors which tend to high egg production, and it is the aim of the poultry breeder to combine high egg-laying factors, or genes, from both cocks and hens in their offspring in order that the resulting chickens may be at least as good egg-layers, if not better than either of their parents, or in respect of any other special character-

istic for which they are being selected. This may be high egg-production, fine plumage, immunity to disease or any other quality although I have taken egg-production as an example. However, selection for a combination of factors is so complicated and uncertain that most breeders confine themselves to selecting for one characteristic at a time.

As to date, it has been found impossible to determine what particular dominant genes an individual possesses except by breeding records or by trial and error, the definite fixing of any desired characteristic is a long and tedious matter involving complicated record keeping of the performance of trap-nested hens, the proving of cocks, and the ruthless culling of individuals which do not come up to the desired standard. The selected individuals are then mated together and the whole process starts all over again until, after several generations, the desired genes have been traced and concentrated in the selected birds. It is not until the offspring of selected high producers have been trap-nested and tested for several generations that it is known whether the experiment has been successful or not. In the case of cocks this is even more difficult and tedious because they cannot be directly tested. They must be mated to hens of a known high laying strain and the resulting chickens tested for their laying qualities, before it is known definitely whether a cock is capable of transmitting the characteristics of his parents.

When the expert knowledge, time, patience, and uncertainty of this tedious process are taken into consideration it is not particularly surprising that the cost of guaranteed birds is high; the astonishing thing is that the prices demanded are not very much higher. However, the point to be noted is that breeding for high egg-production, or any other characteristic, is a very intricate and highly scientific matter involving a considerable knowledge of the latest discoveries in genetics and not to be lightly undertaken by enthusiastic amateurs who have not taken the trouble to study the matter in all its aspects. Put in a nutshell, the object is to select all those individuals who have the genes for the characteristics desired and breed them together until the required qualities have been permanently fixed and are transmitted with certainty from generation to generation. But this is

more easily explained than done.

In a practical manner how is this accomplished? The poultry keeper who is aiming at the highest possible egg-production throughout his entire flock will naturally commence only with the best birds procurable, in order to save himself a great deal of time and trouble. Usually he would demand a guaranteed minimum of 200 eggs per bird per annum for all the birds purchased. And he would have to pay a very stiff price for this initial breeding stock. Probably at least Rs. 50 per bird, if not more. This is one of the items which accounts for the high capital expenditure required in starting a really up-to-date poultry farm.

In order to maintain this average, if not improve it, he would have to mark each of his birds with a numbered ring fastened round one of her legs, and then keep consistent statistics of the number of eggs produced by each bird over the whole laying season. This he would accomplish by installing trap-nests, another expensive item, out of which the laying hen once having entered cannot escape until released. Several times a day he would be compelled to go round his laying houses releasing the hens which have laid and recording the egg under that hen's particular number in his laying record. At the end of each month he would add up the number of eggs laid by each hen and after several months he would get a very fair idea of the laying capacity of each individual hen. Those which were obviously under the average would be immediately eliminated as not worth their keep and also not worth keeping for further breeding purposes. On the other hand, those hens which were obviously laying well above the average would be shifted to a special breeding pen and their eggs laid aside to be hatched. As soon as possible these hens would be mated to a cock of known transmitting ability and would be kept for breeding as long as they laid a reasonable number of eggs, they being exceptionally valuable birds. Some hens have been known to go on laying for as long as five seasons, but this is very very exceptional. The majority of hens lay fewer eggs in their second season than in their first and are not worth keeping after this. Here is another important point which should be borne in mind. Hens only lay for two

seasons. Some of these exceptional birds might be expected to produce progeny capable of a higher egg-production than either of their parents and it is the special high layers which produce high production strains when their characteristics have been definitely fixed. A strain is only considered to be fixed when the special qualities for which they have been bred are regularly transmitted by both cocks and hens without deterioration. While our poultry breeder is building up his strain the selection of cockerels is a still more difficult matter. Each cockerel would have to be penned with hens of known high production and the egg yields from the chickens from each pen separately recorded. In this way it is possible to determine whether particular cocks are able to transmit the egg-laying characteristics which they are supposed to inherit. Unsatisfactory cocks would be culled and only the best kept, the utmost use being made of them for breeding purposes. By adopting this procedure for many generations the desirable qualities of the strain would be fixed permanently because all undesirable birds would have been eliminated before they have had an opportunity of transmitting their undesirable qualities to the breeding stock.

HYBRID VIGOUR.—For some reason, as yet imperfectly understood, two different breeds of the same species if mated together very often produce hybrid offspring superior to both parents with regard to size, fertility, and resistance to disease. This is called hybrid vigour. It may seem that this statement contradicts what I have said above about pure-bred strains. But this is not the case. A pure breed as fixed for certain qualities, as mentioned previously, breeds true from generation to generation provided a certain number of undesirable individuals are systematically culled. With a hybrid this is not so. The favourable characteristics last only for one generation and hybrids bred together do not show any advantage over their parents, in fact, they are generally below the average of either parent. However, this circumstance has its advantages for the poultry breeder. Provided he selects his laying stock by breeding from two different breeds in each generation and only uses the hybrids for commercial purposes, he can enjoy the advantages of perpetual hybrid vigour. Unfortunately this entails the

keeping of two separate and distinct pure breeds from which to make his matings of hybrids. For instance, it has been found that Jersey Black Giants and White Leghorns bred together give a hybrid which lays more eggs than either parent. So in order to keep this hybrid for egg-producing purposes it would be necessary to maintain a pure flock of Jersey Black Giants and another pure flock of White Leghorns which would be bred together to obtain a hybrid cross from which the breeder would get his increased number of eggs. Unfortunately it has been found that among different crosses hybrid vigour is due to different causes, so here again results can only be obtained by a tedious process of trial and error. The breeding of fowls for high egg laying and hybrid vigour has lately been undertaken on a large scale in England and America and firms who specialize in this business are prepared to supply day-old hybrid chicks which are guaranteed to lay an average of 200 eggs per bird per annum. I can see no reason why these chicks could not be imported from either England or Australia by air. On my own poultry farm I obtained the same result by breeding pure Rhode Island Reds, which I bred myself, to the best local hens I could find, of which there was always a plentiful supply, without any necessity for importing stock birds. The result, taking it by and large, was very successful. I got a much larger and better table bird than the local breed and a considerably increased egg-production but still not so great as my pure bred Rhode Islands. I continued the experiment as will be explained in the next section.

GRADING UP.—Crossing high grade birds, usually cocks, with country poultry in order to improve the local breed is called grading up and is a very useful method of getting an improved flock quickly and cheaply, although it takes many generations to make its effect worth while, and by itself will never produce egg layers of the highest class. It also needs a continual supply of pure bred cocks if the experiment is to be continued for any length of time. However, in the first generation you gain the benefit of hybrid vigour and if you never use your hybrid cocks for breeding purposes but always mate pure bred cocks to your hybrid hens you very soon begin to get a much improved flock, in size and

plumage if not from the egg laying point of view. In my experiment with Rhode Island Reds and local fowls, there was an immediate improvement in size and plumage and although I did not keep trap-nest records it seemed to me that egg production was gradually improving. In any case hybrid birds of the third and fourth generation were almost indistinguishable from pure bred Rhode Islands and far superior in all respects to the country bird.

SEX-LINKED INHERITANCE.—Of the chromosomes in the reproductive cells one pair constitutes the sex chromosomes and are the determiners of sex. These chromosomes also carry the genes for other characteristics, one of which happens to be colour and markings of plumage. These peculiarities of plumage are transmitted together with sex by the same chromosomes and each different sex therefore is liable to have some distinguishing plumage characteristic which differentiates it from the opposite sex. Hence the sexes can be distinguished as soon as the chicks are free from their shells. This is called sex-linked inheritance. Of course, other characteristics are also transmitted by sex-linkage but they do not concern us. If a black cock is mated to a barred female, on account of sex-linkage of sex with barredness, all the male chicks will be barred and all the females black. Thus, even when the chicks first emerge from their shells it is possible to distinguish the cock chicks from the hens and there are firms engaged in the day-old chick trade which are prepared to supply day-old chicks guaranteed to be either 100% cocks or 100% hens. By a little careful management hybrid vigour can also be combined with this sex-linkage and a very useful hybrid offered. However, as with hybrid vigour the advantages are lost in the second generation when the plumage becomes mixed equally between the two sexes. So here again two different pure breeds must be kept in order to obtain the benefits of sex-linkage as a permanent institution unless sex-linked chicks are purchased from a specialist breeder. The following table shows the breeds which can be crossed in order to obtain the benefits of sex-linkage. One column is headed male which means that a male of any breed in that column if mated with a female of any breed in the column headed female will pro-

duce sex-linked chicks in which the plumage varies with sex in so marked a manner that the sexes can be separated as soon as the chicks are out of the shell. The most important point to be noted here is that the male chicks will have plumage resembling that of their mother and the females resembling that of their male parent. Thus if a black cock, of any breed, is mated to a barred hen, of any breed, the pullet chicks will all be black and the cockerel chicks all barred, the barred characteristic being dominant.

Generally speaking, if a cock of any gold breed, which includes browns and reds, is mated to a hen of any silver or light breed which includes white, the resulting male chicks will resemble their mother and will be light or white coloured, and the female chicks will resemble their sire (father) and be gold, red or brown. There is nothing hidden, occult, or mysterious about breeding sex-linked chicks.

With detailed information, and by the use of the table which follows, any poultry keeper, on however small a scale, even with only one cock and a few hens of the right breeds, should be able to breed sex-linked chicks without the possibility of error. Provided, of course, that he is dealing with pure bred fowls of known breeds. Any old nondescript village *murghi* will not do, for the very good reason that its genes for plumage are all mixed up and it is already a hybrid with which nothing can be done.

However, if one is prepared for disappointment, it might be worth trying with some village poultry which has never been interbred with European breeds and might therefore be a pure strain. I doubt whether this would work but very little, if any, loss would be incurred in making the experiment and there is a faint prospect of success.

MALES.

Black, brown, or any dark Leghorn.
Golden or Partridge Wyandotte.
Golden Campine.
Red Sussex.
Brown Red Game.
Rhode Island Red.
Any Black breed.

FEMALES.

White Leghorn.

Silver or White Wyandotte.

Silver Campine.

Light Sussex.

Ancona.

Duckwing or any light or white breed.

Barred Plymouth Rock or any barred breed.

Rhode Island Red cocks and White Wyandotte hens make a good cross.

You will observe that, as far as possible, breeds have been kept together in the above table. For instance, should our poultry fancier decide that he wished to keep Leghorns, on account of their heavy egg-producing reputation, and also enjoy the benefits of sex-linkage, he will have to keep separate pens of Black or Brown Leghorns and White Leghorns, the cocks of the dark Leghorns would be bred to the hens of the White Leghorns and the eggs hatched. The cockerel chicks would then resemble their mother and be white and the pullet chicks their father and be dark.

The breed would still be pure Leghorn, but merely of two separate colours, and all the desirable characteristics of the Leghorn breed such as small size and small appetite, energetic foraging, hardiness, and high egg-production would be fully preserved with the additional advantage that the chicks could be separated into males and females as soon as hatched.

Of course, the same principles apply to Golden and Silver or White Wyandottes, Red and Light Sussex, Golden and Silver Campines when crossed. The resultant hybrids will only be a cross between two different colours in the same breed, and the general appearance and all the particular advantages of the particular breed, whatever they are would be preserved intact. This would be far the best procedure to adopt in breeding day-old chicks. Practically a pure breed could be offered with the additional advantage that the seller could offer all cocks, all hens, or definite productions of each as desired, with the absolute certainty that his customers would be getting what they asked for—a no mean advantage and attraction.

From this very sketchy description of the principles of genetics, which has been deliberately over-simplified in order to make it more easily intelligible, the prospective poultry keeper should be able to glean sufficient knowledge to enable him to conduct his breeding operations in an intelligent manner and with a full knowledge of what he is doing. A study of this chapter should prevent him from making a great many expensive mistakes, but the enthusiastic amateur is advised to read it over carefully several times. It contains a great deal of vital information, based on practical experience, compressed into a very small space. However, it does not pretend to deal at all thoroughly with the very intricate science of genetics, the youngest of the biological sciences, and the reader is advised to read up the subject much more thoroughly, especially if he intends to take up poultry farming seriously and on a large scale. It is a subject of enthralling interest especially to all those employed in animal breeding of any kind but more than a superficial knowledge is essential for success. The following books are recommended. The first two are written in a popular style and are easy to understand, the third is decidedly tough but gives all the facts.

1. GENETICS, in the "Penguin" series.
2. THE SCIENCE OF LIFE, by H. G. Wells and Julian Huxley.
3. MODERN GENETICS, by G. H. Waddington.

CHAPTER III

BACKYARD POULTRY KEEPING

PROVIDED that a good start is made with a correctly designed and properly constructed labour-saving poultry house and the essentials for success are constantly kept in mind, backyard poultry keeping is the most successful and profitable way to keep poultry. This has been proved by innumerable poultry keepers throughout the world. A few hens, say half a dozen at the most, of a suitable breed, kept under proper conditions of hygiene and given plenty of exercise, can be fed on the food scraps left over from the meals of any average family and therefore the cost of food is practically nil. By obtaining the family supply of eggs without any expenditure on food you are getting something for nothing, a highly satisfactory state of affairs.

The only reason why backyard poultry keeping has not been more universally adopted is that most people seem to be ignorant of its ease and how to set about it. Absolute cleanliness is one of the essentials of success, but a poultry house and run kept in an indescribable state of filth, with several months' accumulation of droppings contaminating the house and run, can only lead to the breeding of vermin, disease, and certain failure. With a carelessly and thoughtlessly designed house the labour entailed in regular cleaning and whitewashing is so great and inconvenient that very few poultry keepers will be bothered to keep their houses and runs in that state of cleanliness and neatness which is absolutely essential. The poultry house, which will be described first, is designed specially to make all the operations of looking after the occupants as easy and labour-saving as possible. Thought and care in having the design carried out in a thoroughly substantial and workmanlike manner will repay the initial expense many times over both in labour saved and profit gained. Several dodges will be suggested for making the initial cost of materials as low as possible, but a really

efficient small poultry house cannot be constructed for nothing.

Although they have been domesticated for centuries fowls are essentially wild birds still and the more artificial the conditions under which they are kept the greater the care required to supply them with necessities for a healthy existence, especially when they are kept in a confined space, a condition which is absolutely foreign to their natural habits. In their wild state jungle fowls roam over very extensive areas in search of food and they have to work very hard and take a great deal of exercise to get it. They live a life passed entirely in the open air, even at night, and the more nearly the conditions under which they are kept approximate to the circumstances of their wild life the better. In the mild climate of India there is no need to mollycoddle fowls by keeping them shut up in very small and stuffy houses. I have kept hundreds of fowls with perfect success in houses which consisted merely of large frames covered with wire netting under a substantial and thoroughly waterproof roof, and I consider this the best and most healthy way to keep large flocks of laying hens in India. It also happens to be the cheapest method as far as accommodation is concerned.

The essentials for successful backyard poultry keeping are as follows:

1. An efficient and well-constructed house.
2. Absolute cleanliness.
3. Plenty of exercise.
4. Proper food.
5. Clean water and plenty of it.
6. A constant supply of coarse grit and broken sea shells.
7. An efficient dust bath.
8. Plenty of fresh green food.
9. Freedom from disease and vermin.
10. Attention to the special needs of the hens.

Each of these items will be dealt with fully in separate sections, but there are some general remarks which should be mentioned first. Fowls are unfortunately temperamental birds and respond to care and attention. But they respond unfavourably to neglect and forgetfulness. It is absolutely

essential that they should get the proper variety of food at regular intervals. This means that they must be fed at the same time every day without fail and have water, grit, and shell constantly before them. Any failure in regularity or shortage of fresh drinking water will put them off laying. Fowls are birds of regular habits, as are all wild animals; they like to get up and about at the same time every morning and go to roost at the same hour in the evening. If they are harried and chased about they will not lay, so that when they are let out of their runs there must be a perfectly obvious entrance to their roosting place which they can find without being driven to it. Fowls also like foraging and scratching about for their food so if there is no large open area in which they can do this they must be made to scratch and take exercise artificially. They like dry soil underfoot and if they are kept in any place where their feet are constantly wet they will soon pick up diseases and die. They are in the habit of moulting their feathers and at that time go off laying and require special care and attention coupled with special food.

Women take more interest in poultry than most men and therefore make good poultry keepers. They have a natural sympathy for helpless creatures which are entirely dependent on them for the necessities and comforts of life, and are quick to notice signs of discomfort and to put the matter right. They are accustomed to looking after families and ministering to their comfort and so realize without being told that no creature can prosper unless it is properly looked after. They are also equally quick to notice any falling off in the number of eggs which are being laid and to seek for the cause of the deficiency. They find no difficulty to work up a real interest in their poultry-yard and if they are possessed of energy and initiative will begin to make experiments on feeding for themselves and note their effects on egg-production. There is ample scope for personal experiments of all kinds. Women also take a great interest in the welfare of growing chicks and realize more fully than men that little creatures are exceedingly delicate and require a great deal of sympathetic attention if they are to thrive and become robust. Provided women know what conditions are necessary for

success they are more likely to see that they are provided than men are and do not expect any animals to thrive if given no attention at all.

HOUSING.—Of course, in backyard poultry keeping space is of the greatest importance and must be made the most use of. However, the more space fowls are allowed to forage about in, the healthier they will be. The dimensions given in this section are the absolute minimum required for success and if they can be increased a little so much the better. Generally, the kind of house recommended consists of two stories to conserve space as far as possible. Each story is made separate for ease of construction, cheapness, and portability. At a pinch, either story can be used separately, but this is not advisable. The bottom part consists of a compartment four feet wide, four feet high, and four feet deep from back to front. This will form a scratching shed, the floor of which should be covered with about two inches of litter in which the feed of hard grain will be buried in order to give the hens plenty of exercise in scratching away the litter and finding their food. This lower part is fitted with two doors in front, provided with wooden bars set two inches apart, through which bars the hens can thrust their heads to get at the food, drink, grit, and shell which is supported of the ground on continuations of the side members of the lower story. This part of the house is fitted with a substantial top, preferably of one-inch tongued and grooved planking, on which the upper story will rest. The back can either be boarded up or covered with substantial one-inch wire netting. One side of the lower story is fitted with a movable shutter, covered with wire netting, which can be moved to either side. One side is thus left open. The idea of this is that a movable wire covered run can be attached to one side of this lower compartment, the side which is left open, and when the hens have run for a month in this attached run it is moved to the other side, the movable shutter being placed in the open side previously occupied by the run. In this way it is possible to change the ground on which the fowls run every alternate month or every alternate two months while a crop of green stuff for their consumption is grown on the land previously occupied by the movable

run, and which has been well manured by the fowls' droppings. In this manner the ground on which the fowls run is kept sweet and the old space instead of being wasted, is used for gardening purposes. Thus nothing is wasted, space, one

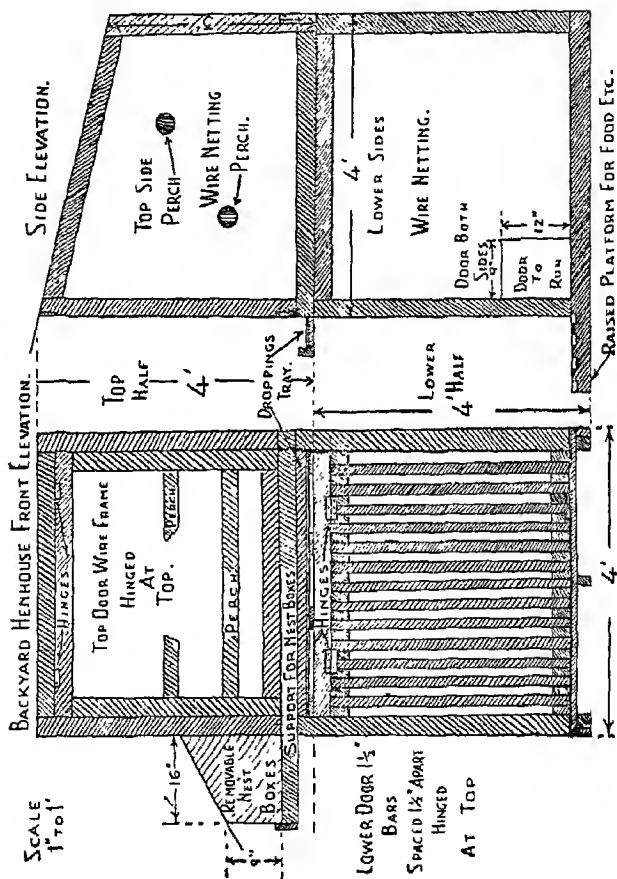


PLATE I
BACKYARD POULTRY HOUSE

movable run instead of two, and the fowls' manure all contributing to economy with the least expenditure of work, energy, and time.

The uprights of this house throughout should be three inches square and the planks used should not be less than three-quarters of an inch thick, in order to make a durable and satisfactory job. As no pieces longer than about six feet will be required, these short lengths can be obtained from some builder who has rejected them, at a lower price than longer lengths. The top of this lower portion should be framed with three-by-threes and a stout top of one-inch planks nailed to this frame. The lower ends of the uprights can be framed with planks six inches wide by one inch thick, to form an enclosure six inches high to contain scratch-litter, which the planks will prevent from being spread about by the hens. The two side planks of this lower frame should be extended forward about nine inches and two-inch bars, spaced one inch apart, nailed to their upper surface, to form an elevated platform on which feeding and drinking utensils can be placed. The hens can reach their food and drink by thrusting their heads between the bars in the two doors which form the front of this lower story. There is plenty of length here for food utensils and sufficient should be provided for all hens to feed simultaneously. Empty canned herring tins will do, provided they are kept scrupulously clean. The two doors in the front are for the purpose of easy access in order that the litter can be easily removed and replaced and the inside periodically whitewashed without the necessity of removing the run from the open side. These doors also make it easy for the hens to find their way into their sleeping quarters in case they have been let out for a run in the garden. The front could equally well be formed by an easily removable shutter with bars, just like the side shutter, if it is considered to be easier and cheaper to make.

The essential function of this lower half is to provide a covered scratching shed with one open side to which a long wire covered run is attached. The other side is closed by a movable shutter which can be shifted to the opposite side when it is decided to change over the run to fresh ground. Two doors or a movable shutter are provided in front for

easy access to the interior and a gridded platform is provided, formed by an extension of the two lower side members, on which to place food utensils out of contact with the ground and without the necessity of opening any doors. This is a labour-saving feature which will save a great deal of time and trouble and keep both food and drink free from contamination with the ground, a very important hygienic necessity.

The upper portion will have the same three-by-three inch uprights and part-framing as the bottom and be of the same dimensions. This will form the roosting house to which movable nest boxes will be attached, outside at one end, and in this case the wire covered front frame will be hinged at the top so that it can be raised out of the way and propped up with a stick or bamboo when the inside has to be cleaned or whitewashed; this hinged front will thus give unobstructed access to the whole of the interior, a great convenience and labour saver. In the sliding floor of this upper roosting compartment there should be an opening about eighteen inches long and nine inches wide to give the hens access to their roosts from below. There will, of course, be a corresponding opening in the top of the lower compartment. This floor of the upper story will be formed by a sliding sheet, a cement-asbestos sheet is recommended, one-quarter inch thick and no less, which will slide on the roof of the lower compartment and have a hole corresponding to the hole in the roof of the lower story. A short ladder placed at an angle, with rungs about six inches apart, will enable the hens to hop up to their sleeping quarters without trouble. The sliding tray is for the purpose of catching droppings which can thus be cleared every day or every two days by simply pulling out the tray and tipping the droppings into a box kept for the purpose. In building this house I recommend that the roof be made of a single sheet of cement-asbestos material which is sold in sheets eight feet by four feet. If a single sheet is purchased and one piece of three feet two inches long is cut off from one end to form the tray, the remainder will be sufficient for a perfectly adequate roof in one piece without waste. This house has been designed to use material, like the cement-asbestos sheet, to the greatest possible advantage and without

wasteful cutting and discarding of any short pieces. In building poultry houses, of whatever dimensions, this principle should be kept in mind and the houses designed to suit the dimensions of the material available, without waste or at least with the irreducible minimum of waste. There is not much advantage in buying expensive sawn timber only to use it for firewood as a good many people do.

In building the upper story or roosting house, the front and back bottom pieces will have to be fixed about two inches from the bottom of the uprights in order to allow space for the withdrawal of the tray with its burden of droppings. These front and back longitudinals should be extended towards the left, beyond the main house, about sixteen inches to form supports for the removable outside nest boxes, which rest on these extensions. Spaces about nine inches wide and ten inches high must be left in the side of the roosting compartment to give access to the nest boxes. The roof should be one foot higher in front than at the back and have a good overhang all round—there is plenty of material to permit of this. A batten about twenty-two inches long should be nailed along each end touching the back, about six inches from the floor with a notch cut in it eighteen inches from the back of the house to take a two-inch or three-inch bamboo as a perch. Above this, about ten inches higher, another and a shorter batten should be nailed with a notch for a similar bamboo situated nine inches from the back. By making the perches in this way they are easily removable for cleaning and are out of the way when the inside has to be scrubbed and whitewashed. The internal fittings of all poultry houses should be easily removable in this manner, without necessitating the pulling out of any nails. Further details of this poultry house will be seen from the drawing (Plate I) accompanying this section, which should be carefully studied and the details fully understood before construction is commenced. There is no difficulty about the removable run. This is merely a stout wooden frame about twelve feet long, six feet wide, and three feet high, covered with stout one-inch wire netting. One half of one end is left uncovered and placed against the uncovered end of the lower half of the poultry house. If space does not permit of

a run six feet wide, one three or four feet wide may be substituted, but the largest run which can be accommodated should be used.

This type of house offers the following advantages and labour-saving features. In designing poultry houses these points should be assured:

1. By dividing it into an upper and a lower story limited space is made the utmost use of. Very necessary in the case of backyard poultry keeping where space is the limiting factor. The upper part is accessible without stooping.
2. Ample access by large opening shutters or doors.
3. Plenty of ventilation without drafts.
4. Sliding tray, accessible from front, to catch droppings.
5. Removable outside nest boxes which cannot be fouled by droppings of birds perching on them. They are dark and secluded.
6. Scratching shed where birds can find plenty of exercise and shelter even in wet weather.
7. Elevated grid for food and water utensils, outside the poultry house where they can be immediately placed or refilled without the opening of any doors and where they cannot be contaminated by the birds themselves.
8. Removable and reversible closed run.
9. It can be constructed with the irreducible minimum of ironmongery. If shutters are substituted for doors, no iron work at all is necessary.
10. It is made in three parts for portability and ease of construction. Top and bottom stories, each complete in itself, (and could be used separately), and a movable run.
11. It is so simple that any village *maistry* can make it with purely local materials.
12. At a pinch it could be improvised out of a large packing case, some additional short ends of wood, and some wire netting. The general principles should be adhered to, and the dimensions maintained. It may be larger but not smaller.

Some people might be inclined to think that all this attention to ease of maintenance and attention are not worth the bother of construction and extra expense, but can be very easily dispensed with on the score of economy. They are sadly mistaken and will very soon be disillusioned. The keeping of poultry, even on the smallest scale, involves a very great deal of uninteresting routine work which has to be undertaken every day without fail. Anything which contributes to the lessening of effort required in carrying out this daily drudgery will, during the course of a year or more, make a remarkable difference to the amount of work which has to be done and will make that work far easier and pleasanter. As there is no possibility of avoiding the work if reasonable results are to be assured it is just as well to make it as easy and pleasant as possible. A small flock of happy and contented birds which are clean and healthy and produce a regular supply of large clean eggs are not only a source of pride and satisfaction to their owner but an ornament to the establishment as well. Keep everything about your birds clean and neat, give them proper food, clean water, and plenty of exercise and you will have very little to complain about.

A chicken house of this design can be made to be an ornament to any garden or backyard. The outside wooden parts should be treated with at least two coats of some good wood preservative such as creosote, or one of the proprietary preservatives such as "Jodellite" or "Noxo," to prevent attacks by white ants as well as to preserve the wood from rot and the effects of the weather. All inside parts should be whitewashed and re-whitewashed every month with a lime wash in which about two ounces of crude carbolic acid to each bucket of wash has been dissolved. This crude carbolic acid is usually sold under the name of "Phenol." If not obtainable, any strong disinfectant such as "Izal" will do. The roof of the main house and nest boxes can be painted with red "Siderosthene" paint which will resist the sun. Of course, the inside of the nest boxes must be whitewashed just as often as the inside of the poultry house, both upper and lower stories. The wooden uprights and long members of the run should also be treated with creosote and after the

creosote is thoroughly dry it may be whitewashed monthly in the same manner as the rest of the house. Both painting and creosoting should be renewed at least once a year. This will keep your hen house looking neat and tidy as well as clean and hygienic. Without this attention and regular and systematic cleaning it will soon become an eyesore and a breeder of disease and vermin.

POSITION: This poultry house should be so placed that there is plenty of space on either side of it for the wire covered run, however long it may be. It should also, if possible, face away from the monsoon or be in such a sheltered position that rain does not beat into the front of the house. Hens like shade so if a part of their run can be shaded by a tree during the hottest part of the day, so much the better. If not a gunny bag can be thrown over a part of the run to give them shade from the sun.

If the soil on which the house is placed consists of heavy clay, which holds moisture, the space under the roosting house, where the hens are going to scratch, should be raised above the surrounding surface by at least two inches with well rammed earth. As a further precaution against the scratching shed area getting flooded in heavy rain, either a gutter (made out of half a large bamboo) can be fitted to the lower edge of the roof and the rainwater led well away from the house, or a soak trench can be made under the lower end of the roof to catch and hold the rain until it has soaked into the ground. This trench should be made about one foot six inches wide and not less than two feet deep, filled with rocks or large stones. The largest stones should be at the bottom, gradually decreasing in size towards the top where they should not be more than one-half an inch square. The lowest ones may be as large as you like. The trench may be finished off with a layer of coarse sand to within three inches of the surrounding soil.

You will notice that the top triangular portions of the sides are finished off with wire netting in order to give plenty of ventilation. As the droppings tray might suffer from rough handling unless strengthened it would be just as well to fit it with a frame of two-inch by three-quarter inch wood on its under side, with a couple more pieces of the

same size running from back to front just clear of the central opening. As well as acting as strengthening pieces these will make the tray slide more easily. Lastly, do not forget to treat the bottom ends of all uprights and the lower edges of all planking which touch the ground very thoroughly with wood-preservative or you will very soon find that your nice new poultry house has been devoured by termites, as the busy and voracious little white ant is called by some Pundits.

CHAPTER IV

BACKYARD POULTRY KEEPING (*Continued*)

ABSOLUTE CLEANLINESS: Practically the whole secret of keeping poultry in confined spaces, such as backyards, healthy and in good laying condition is absolute cleanliness. The poultry house described in the last chapter is designed specially to make this as easy as possible with the minimum of hard work; however, some hard work is none the less necessary, and should be undertaken as a regular and daily routine.

The very first thing to be undertaken every morning is to draw out the droppings tray and tip the droppings into a box kept handy for this purpose. The next thing to be done is to give your hens their morning feed and to fill up their water trough, first cleaning it out if necessary. The reason for tipping out the droppings first is to prevent any possibility to the droppings getting into the food or water if this job is done after the food has been placed in position. The droppings tray must be scrubbed with a stiff brush and water with a disinfectant in it at least once per week. Once every two or three months the whole interior of the fowl's accommodation, both upper and lower compartments, should be thoroughly whitewashed with a solution of slaked lime in a bucket of water to which a couple of ounces of crude "phenol" has been added. This should be preferably sprayed on, but if no sprayer is available it can be thrown on as hard as possible with a large whitewash brush. At the same time all the woodwork of the run should also be very thoroughly whitewashed. The nest boxes are made removable in order to make this whitewashing and the renewal of the nesting material as easy as possible and it is strongly advised that this whitewashing should be done not less often than once a month. As lice and other vermin breed apace in all tropical climates, it is advisable to examine the inside of the roosting compartment and nest boxes at

frequent intervals and if lice are observed the whole interior should be sprayed with one of the commercial solutions of DDT. It would be a wise precaution to make this a weekly duty, at the same time as the droppings tray is scrubbed.

PLENTY OF EXERCISE: As I have said before, fowls in their natural state take any amount of exercise because they cannot find the food they need in any other way. This keeps them in a state of hard condition which it should be the aim of the poultry keeper, under artificial conditions, to emulate as far as lies within his power. Hens which are permitted to get fat will not lay. This is the object of the scratching shed and the wire covered run. Every effort should be made to give your hens as much exercise as possible and should they commence to get fat and lethargic their food ration should be cut and some means found to give them more exercise. To attain this end all the hard grain should be buried every morning under the litter which will cover the floor of the scratching shed. This will keep your hens busy most of the day scratching about and looking for the buried food. This will go a long way towards giving them the exercise they need. Another and very important way of giving them additional exercise, they can practically never get too much, is to hang bunches of green stuff from the top of their wired run, at the end furthest from the poultry house, in such a manner that they will have to jump to get it. For this purpose, and to make the fixing of the bunches of greens easier, a lifting door is indicated at the end of the wired run. This door can be lifted, the bunch of leaves fixed to it, and the door closed. In another section suggestions will be made for the growing of suitable green vegetables and the use of sprouted grain. If it is suspected that the hens are not getting enough exercise by these two means, planks should be fitted across the run so that the hens have to jump onto them and off again, in order to reach the end of the run and their green ration which they will appreciate enough to take any trouble to obtain.

PROPER FOOD: Fowls are omnivorous birds and generally speaking, anything which is fit for human consumption is also good food for them, whether this is boiled rice, meat and fish, or green vegetables not quite good enough for the

family. A large enamelled basin should be kept in the kitchen and all the outer leaves from cabbages, lettuce, or other greens, as well as the stalks, ends, and peelings should be thrown into it together with surplus rice, bread crusts, scraps of meat and fish or anything else that may be available. At the end of the day, this should be made into a crumbly mash and fed to the hens about five in the evening. The amount necessary is two ounces per bird and this amount should not be exceeded if another two ounces of hard grain is fed to the birds in the early morning. There is a note of warning to be given here, and it is most important. Dal should not be fed to hens. It is far too heating and if given will cause them to contract a liver complaint which will very effectually prevent them from laying any more eggs. Other than this there is nothing in the ordinary Indian diet which can do your hens any harm. Sour or curdled milk is excellent. Potato peelings should be boiled in separate water and the water thrown away because it is not good for fowls. Bread crusts, which can be as stale as you wish provided that they are not mouldy, should be soaked in hot water and all the surplus water squeezed out before adding to the mas. Cabbage stalks should be cut up into small pieces as should all vegetable and meat or fish scraps. Fish bones should be discarded. Laying hens need a good deal of animal food and about two to four ounces should be included in the mash every day. The total amount needed for six birds will be twelve ounces per day or two ounces per bird if fewer are kept.

It is generally advised that the hard grain ration should be given at night, but this is inconvenient for most households and if the mash ration is given in the morning it is not possible to keep the hens busy all day searching for their grain in the litter of their scratching shed. I advise two ounces of hard grain in the early morning and another two ounces of mash composed of food scraps in the evening. There is no harm in mixing surplus curry, massala and all, with the mash as long as it does not compose more than about one quarter of the total quantity. The chilli and other spices have a stimulating effect on egg-production.

As long as they are kept scrupulously clean and are not

allowed to get rusty, empty herring cans may be used both as food and water receptacles. When rusty they should be thrown away and new ones substituted. Sufficient receptacles should be supplied for all the hens to get their food simultaneously and the tins should be so placed that the hens can easily reach them through the bars in the front of their scratching shed. Three food tins will be sufficient for six hens. It should be remembered that the mash should not be a sloppy mess. There should be only just sufficient water to make it a dry crumbly mass without any stickiness.

It should be remembered that pieces of gristle and skin not fit for human consumption are quite good food for hens and should not be wasted.

In England and America machines are sold for shaving thin slices of raw bones, which are called green bone. This is excellent food for hens and supplies them with the calcium necessary to form the shells of their eggs as well as other important substances. Provided that it is possible to scrape or shave raw bones in such a manner that they can be easily swallowed by your birds this is an excellent addition to their diet. However, sharp bone fragments should not be allowed to find their way into the mash or your birds will choke themselves.

In a state of nature fowls feed on every conceivable kind of grain and grass seeds eked out with insects and green leaves of grass or any other green and succulent vegetation. This is a highly convenient circumstance for the poultry keeper because it means that, wherever you may be, the locally available grains will do to feed your poultry on. Most poultry books recommend whole or crushed maize, wheat, or other European and American grains such as buckwheat, which are not available in India unless they are imported. This need not worry the local poultry enthusiast as he can feed his hens with equal efficiency on any grain which is most easily obtainable—paddy, wheat, jowar, ragi or anything else. The point is not to give them too much and to mix the grains as much as possible, avoiding those grains only which are used for the production of oil, such as gingelly. Sunflower seeds which do not contain too much oil

can however be fed on occasion. Any sunflowers in the garden which have finished flowering should be thrown into the run and the birds will get quite a lot of useful exercise in picking the seeds out of the heads. In fact, sunflowers, of all kinds, can be grown in the garden both for appearance and utility. Where rice bran is available at a cheap price this makes a good foundation for mash.

CLEAN WATER AND PLENTY OF IT: In a hot climate like that of India it is essential that a plentiful supply of clean fresh water should always be available to your birds. The water containers should never be allowed to become empty. You must recollect that the contents of an egg consists mostly of water and if your birds have insufficient water they will lay fewer or even no eggs at all. If you find that the water receptacle you have supplied is so shallow that the water is finished too soon, either by evaporation or the thirsty birds finishing it, a deeper receptacle should be substituted, one which will hold enough water for the whole day.

GRIT AND SHELL: As no birds have any teeth they are furnished with a very muscular organ called a gizzard in which the hard grain on which they feed is ground to a pulp between pieces of grit or small stones, by the continuous action of the gizzard, to which both the stones and food find their way before they pass into the stomach. Unless a fowl has an ample supply of grit, with sharp edges, it is unable to digest its food and will lose condition and eventually die. Even the smallest chicks, immediately they are free from the shell, require plenty of very fine grit. For full-grown hens, grit of about the size of peas is the correct size. This can be obtained from the bed of any stream or from the sea shore. If the sea or stream has not already sorted the grit into approximately equal sized particles, the largest and smallest grains should be separated roughly by screening. The harder the kind of grit the better. The best is the semi-transparent grains of yellow quartz sand from the disintegration of granite rock which can be found in the streams all over the south of India. In Bengal, where coarse sand is not common, it may be necessary to provide the birds with an artificial grit made of broken crockery from which all the large and very small pieces have been carefully

separated. A large pan or tin of coarse grit, well filled, should be available to the birds all the time.

BROKEN SEA SHELL: As all birds, and especially fowls which lay a large number of eggs, need lime for their eggshells and the soil of India is notoriously deficient in lime, it is absolutely essential that your birds are amply provided with this essential ingredient to egg-production. The best form of lime for hens is crushed sea shells. Where oysters are plentiful their well crushed shells form a very good kind of lime, but the crushed shells of any shellfish, whether fresh or salt water, are just as good. For very small chicks the crushed shells of eggs are excellent. On most sea beaches, as the tide goes out it leaves a narrow line, or several lines, of minute white sea shells on the surface of the sand. These can be scraped off the beach with a thin piece of wood or tin and form a perfect lime ration for poultry of all kinds, without any necessity to crush them. Ducks are particularly fond of this kind of lime.

DUST BATH: However careful you may be about cleaning and disinfecting your fowl house vermin are bound to breed there and infest your hens. If energetic steps are not taken to keep them within reasonable bounds they will pester your birds to the point of making them seriously ill, and fowl lice may even spread to the house. This is the reason why all poultry houses must be regularly scrubbed, disinfected and whitewashed. One of the best ways of keeping your poultry free from lice and other vermin is to provide them with a suitable dust bath, which they know perfectly well how to use, and in which they will free themselves from their insect pests. A shallow box about six or eight inches deep and at least two feet square and half filled with finely sifted ashes, or if these are not available finely sifted earth should be placed in the chicken run where the hens can use it at all times. It is important that the ashes should be perfectly dry or they will be useless. In the dry season this box may be placed in the wire run, but in the monsoon it must be shifted to the sheltered scratching shed. All insects breathe through numerous fine openings scattered over the whole surface of their bodies, called spiracles. If these spiracles are choked or stopped with dust particles the insect

is suffocated. As the openings are extremely small so must the particles to close them be. This is the reason why any old earth will not do. The finer the earth the better, and the larger the proportion of the very finest particles in the material of the dust bath naturally the more efficient it will be. If you have, for instance, a large proportion of coarse sandy particles in your sand bath and only a small proportion of fine dust it is only the fine dust which is useful and all the rest might as well not be there—it merely wastes space and hinders the action of the fine dust. It is therefore best to use finely sifted wood ashes only. Nearly every Indian household uses charcoal for cooking and there is always plenty of ashes. All that is necessary is to have a handy box in the kitchen near the stove with a split bamboo sieve, with a fine mesh, placed on it. The ashes are tipped into the sieve every day and sifted into the box to be used for your dust bath. There will probably be far more than you need for this purpose and the rest can be used for manuring the garden, in this way. Dry the hens' droppings in the sun and reduce them to powder; to this add as much ash as is available, say twice as much ash as droppings. This makes a splendid manure, but must be used sparingly as it is very strong. The ashes contain potash and the droppings contain nitrogen in a concentrated form, and a certain amount of phosphorus too, so you have a perfect manure containing all the ingredients necessary for plant growth and in an organic and immediately assimilable form. Do not on any account waste your hens' droppings and surplus ashes. To make the dust bath more effective, one pound of talcum powder containing five to ten per cent of DDT, as sold commercially ready mixed, may be added to your ashes, but this quantity should not be largely exceeded. The best depth of ashes is about three inches.

GREEN FOOD: This is just as essential to healthy poultry as an otherwise well balanced diet. Without it they cannot thrive. All the outer leaves of such vegetables as cabbages, lettuce, and other salad greens should be kept, tied into a bunch, and hung in the wire run where the hens will have to jump for it. No mouldy or rotten leaves should be included. The tops of all such vegetables as turnips, knol-

kohls, carrots, beetroots and the discarded leaves and fine stalks of various sags should be treated in the same way. Shells of peas can be chopped fine and included in the mash. Failing anything else, sprouted seed can be bought very cheaply in the bazaar and is one of the very finest forms of green food, or the seeds can be purchased and sprouted at home. In Bombay they are called "mutt." But any edible seed can be used. If there is space available in the garden to grow green stuff for the hens any quick growing sag, cress, mustard, or even an edible weed can be grown. But remember that it must be continually available so you will have to plant a small patch. say a couple of square yards, every week, unless you plant something which can be cut down and will immediately grow again. Barley will do this and so will groundnuts. I grew groundnuts for my poultry and a quick growing kind of spinach; both were excellent. As the groundnuts were grown merely for their leaves they were cut down as soon as they were tall enough to be useful and allowed to sprout again. It is not necessary to allow any plant used for green food to grow to maturity. As soon as the plants are a few inches high they may be used. Lawn grass cuttings make very useful green food, but old and tough grass, mostly stalk, is useless.

DISEASES AND VERMIN: The best way to avoid disease is to start with healthy stock and keep it healthy. If you follow the instructions given in this chapter carefully, systematically, and conscientiously, you are unlikely to be troubled with poultry disease. If you observe any fowl which is obviously sick it must be immediately isolated, treated, and if it does not recover killed and its body burned. My experience leads me to think that it is almost impossible to combat epidemic diseases of poultry in India. By the time the disease has been noticed and the sick bird or birds isolated, they have already contaminated the ground and practically your whole flock is doomed unless it can be immediately shifted to an uninfected locality, which is usually impossible. My advice to you about disease is to start with healthy fowls and make every effort to keep them healthy. Prevention is better than cure, particularly in the case of poultry. Keep a sharp lookout for vermin and if it appears, immediately

disinfect and whitewash your hen house and dust the underside of the birds' wings with one of the commercial preparations of talcum powder und DDT. If your birds have an efficient dust bath and a clean house, which is always kept clean, vermin should not trouble you much. Anyhow you know what to do about it.

GENERAL WELL-BEING AND SPECIAL NEEDS:

If your hens begin to lose their energy and grow listless and cease to lay, immediately suspect too much food and too little exercise. By catching one hen you can soon satisfy yourself whether this is the case. If so cut down the ration to only three ounces of hard grain per day and no mash, but give an increased ration of green food and a little meat or fish finely chopped. Perhaps your birds are getting insufficient grit or grit of the wrong kind. Find out what is wrong by careful observation and put it right. Hens react very rapidly to any little thing which may happen to go wrong, insufficient water, for instance or not enough green food.

The yellow pigment of the egg is caused by a substance called "carotin" and if your fowls do not get enough of this the yolks of their eggs will be of a pale yellow colour and in some cases very nearly white. Yellow maize contains carotin and this is one of the reasons why it is nearly always an ingredient of all ready mixed foods. So whenever maize is available it should be included in the hard grain ration. However, it may not be available so a substitute must be found. Carrots contain carotin and so do tomatoes and all flowers and fruits which have red flowers; so if you wish to have eggs with nice yellow yolks you must supply your hens with a certain amount of maize, carrots, or tomatoes, in their diet whichever happens to be available and cheap. Of the new and powerful insecticides now on the market DDT can be used judiciously, that is in such a way that it does not come into actual contact with eggs. It may be used for spraying houses, runs, and nest boxes and also for dusting vermin-infested hens under the wings where there are no feathers, but Gammexane should not be used as it is liable to make the eggs and flesh of the birds taste of the substance.

WHAT BREEDS TO KEEP: As there is no wide variety of choice in India because the poultry industry is poorly developed in the country and by no means all the breeds kept in England, America, and Australia are available, I would strongly advise the budding backyard poultry keeper to confine himself to Leghorns at least to start with, as these are not only the most suitable breed but are generally available wherever European poultry is kept. There should be no insuperable obstacles in getting a few Leghorns almost anywhere in India. Where there is a Government poultry farm in the locality the superintendent should be consulted.

If Leghorns are kept and it is decided to try to raise sex-linked chickens, the sex of which can be detected from the plumage as soon as they are hatched, White Leghorns should be kept at first and if breeding on a small scale is decided on as an experiment, a Brown or Partridge Leghorn cock should be purchased later and bred to the White Leghorn hens; thus sex-linked chicks will result.

Where it is impossible to obtain Leghorns, Rhode Island Reds, which are hardy general purpose birds may be substituted. They have the disadvantage, from the backyard poultry keeper's point of view, that they are liable to go broody and, of course, cease to lay. But in this case they can be used to bring up a brood of chickens which may be either sold or kept.

White, or any other coloured Leghorns, have the advantages that they are vigorous and hardy, energetic foragers, small eaters, and heavy layers of white eggs. The only disadvantage about them is that for the table they are rather small and have less flesh than the general purpose breeds.

HOW TO START There are two ways in which the economical housewife can start her flock. The first and cheapest is to buy a broody hen and a setting of eggs. As it is very unlikely that the whole dozen chicks, even if safely hatched, will grow to maturity, it may very well be that out of a setting of twelve eggs she will only get the six laying hens she needs. Cockerels should either be sold or used for curry. There is not sufficient space available in most backyards to make the keeping of a cock worth while. The hens

will lay just as many eggs whether there is a cock running with them or not, so a cock just takes up useful space which can be more efficiently used for a laying hen, and he eats good food for which he gives little or nothing in return. In purchasing this setting of eggs every effort should be made not only to purchase eggs from a good egg-laying breed such as a White Leghorn, but also to get a high production strain within that breed, and a guarantee of fertility.

The second, and rather more expensive, way of starting is to buy six young pullets of the selected breed and strain just before they are due to commence laying. By the time they have settled down in their new quarters they will begin to lay and no time will have been lost.

GENERAL HINTS: Some time before you actually purchase your laying stock or while you are looking for a suitable poultry fancier from whom to purchase, you should make a beginning by sowing a small plot with some fast growing leafy plant for green food. In the case of the poultry house of which a drawing is given, both sides of the house where the wire run is to be, can be planted with groundnuts, or one side with groundnuts and one with sag. When the hens arrive or your chicks are big enough to turn into their permanent quarters, you should cover one part of your green food patch with the wire run and allow the hens to eat it as it is. They will very soon finish it, and at the same time manure the ground well with their droppings. When one side has been denuded of its green food, the run should be shifted to the other side of the house and the first area well dug up and replanted with green stuff. The point to remember is that you must supply your birds with a continuous supply of fresh green food. It is no use giving them too much at one time and then a long spell without any at all. If you find, as you probably will, that your hens eat the green crop on one side of the run faster than it takes the other side to grow, you will have to start a third plot, make sprouted *Mutt*, or depend on bought green food, grass cuttings, or some similar substitute. Generally speaking it is necessary to use intelligence and initiative in getting the most out of the space available and to use all resources of land, dropping, ashes, etc., to the greatest advantage.

LITTER: Undoubtedly the best litter available in India is paddy husks. It is composed of pieces which are just the right size, absorbent, tough, and long lasting. As the feed of hard grain is to be buried in the litter every day in order to provide the hens with exercise in searching for their food, if this litter is not kept clean and fresh it will contaminate the food and cause disease. It must therefore be frequently changed. Paddy husks are just as good for little chickens and ducks as for grown hens. If not available, chopped straw or grass must be substituted, cut into one-inch lengths. Moss, fine wood shavings or sawdust will do, but are not so good. Litter should be changed once per week, at least. Oftener if it gets damp or dirty.

POINTS OF A GOOD LAYING HEN: In old fashioned books on poultry keeping, a method was given of judging the capacity of a hen to lay eggs by measuring the distance between the vent and the anterior ribs with the fingers. The idea being that if there was space for the four fingers of the human hands between these points the hen would have ample internal capacity in her egg-laying apparatus and would therefore lay a large number of eggs. I have tried this method on innumerable occasions and, possibly on account of my own stupidity, found it no indication whatever. I may be quite wrong but I decided to discard this empirical method many years ago and I also notice that it is no longer recommended in modern poultry books, so I conclude that other practical poultry keepers have come to the same conclusion that I have. I should say that it is impossible to judge the potential egg-laying capacity of any hen by mere inspection, as to the probable number of eggs laid per annum, I mean. But it is possible to tell a likely looking layer from a hen which shows little prospects of being a heavy egg-producer. However, in the final analysis the only way to really find out how many eggs a hen will lay, or is capable of laying, is by the use of the trap nest and record of eggs actually laid. There can be no mistake about this method, it is scientific and fool-proof.

Potentially good layers should possess the following physical characteristics: have firm and glossy plumage with a pronounced sheen, any hen with permanently ruffled or fluffy

plumage should be instantly rejected. The bird should stand upright and firmly on her feet with tail carried erect and with an alert carriage of the head. Eyes should be bright and remarkable for their clearness and alert look. Any sign of sunken or dull eyes should be looked upon as a cause for rejection. The comb of laying hens is always of bright clear red and of a fine and almost translucent texture. A dull, coarse, or granular looking comb is most unfavourable. Temperamentally a good hen should be alert, vigorous, active, and show an eagerness for food and willingness to forage energetically for it. The flesh should be firm and the bird should show no signs of softness, lethargy, or of laziness. The feet and legs should be clean, smooth, and free from coarse scaliness or irregular roughness and warty growths.

HOW TO TELL A YOUNG PULLET FROM AN OLD HEN: Pullets in their first year show all the signs of youth and vigour, if they don't they are obviously not young. Under the wings, where there are no feathers, pullets have some fine long hairs and a delicate pinkish skin with fine and easily visible veins. Their feet and legs are smooth and fresh coloured. Plumage is bright, glossy, and close lying with few or no damaged feathers.

An old hen will have no hairs in the bald patches under her wings and the skin here will be of an uniform dead white colour without veins. Her plumage will be less bright, firm, and glossy, and some feathers may be rough and damaged. Her legs and feet will not be so smooth and fresh coloured as those of a young bird. There will be a general withered look of age about her and a wizened appearance about her head. If the beak and legs of any bird are dull and off-colour it is a sign of lack of condition whatever the age may be. The claws on an old hen's feet will be coarse and worn, quite unlike the smooth sharp claws of a young pullet.

CHAPTER V

WHAT BREEDS TO KEEP

HENS are kept either for their quick formation of high class flesh, their egg-laying qualities, or for a combination of both. It need hardly be pointed out that the general purpose bird excels in neither quality, but some breeds such as the Rhode Island Red, although its flesh is not of such high quality as that of the famous table breeds, not only has ample flesh but is also a large bird which lays very nearly as many eggs as the White Leghorn which is remarkable chiefly for its high egg production.

It is for the prospective poultry keeper to make up his (or her) mind for which particular purpose he intends to keep fowls and then to decide which particular breed will suit his purpose best. Or very much more probably what is the nearest breed to his special requirements which is available in India. Of course, if he intends to import his initial stock it does not matter very much what breed or breeds he selects, provided it fits his requirements and is suitable for the local conditions. As fowls are tropical birds and were originally in most probability indigenous to India and the surrounding countries, there is not much doubt that any breed will very soon become acclimatized and settle down happily under the local conditions to be found in any part of India, even in the hottest parts, provided they have plenty of shade to rest in during the hottest period of the day and a continuous supply of water. Generally speaking, the climate of India is perfectly suitable for any breed of poultry if the birds are kept under proper conditions:

EGG LAYING BREEDS: These are generally smaller than the breeds of table birds, weighing from three and one-half to four and one-half pounds, are hardy, vigorous, good foragers, small eaters, large egg layers of white eggs, and decidedly ornamental, specially the White Leghorn. This

breed with its pure white plumage and bright red comb makes a very pretty picture of any well-kept lawn, especially when the flock is a fairly large one.

These small breeds of heavy egg producers are for the most part non-broody and poor mothers. They waste no time in sitting on their eggs and therefore, for egg production pure and simple, the best breeds to keep are these non-broody breeds. There are, of course, exceptions to this rule and some hens will show signs of broodiness, but taking them by and large they do not sit.

It is advisable for the beginner to confine himself to a single breed, except as advised later. When he has gained some experience and has made a success of poultry keeping on a small scale, he may add more breeds and indulge in cross-breeding experiments if he wishes. Both White Leghorns and Anconas are light, vigorous, and active breeds which do not get broody and lay a large number of eggs. They are both also small eaters and give the maximum number of eggs for the minimum of food consumed and space occupied. They also do well on a clay soil.

If the intention is to keep fowls on a large or medium large scale and sell eggs and young chickens for breeding purposes, it is quite possible to breed sex-linked* chickens of one breed, say Leghorns, which show sex-linked characteristics and can be separated as to sex as soon as they are out of the shell. This is useful when it is desired to supply all pullets for laying purposes or all cockerels for fattening and table use. In this case it is not necessary to keep two more flocks for cross-breeding purposes, and this can be done on a small scale with perfect success. It is only necessary to keep a flock of pure bred White Leghorns for breeding purposes and sufficient Brown or Partridge Leghorn cocks to cross with the white hens in order to produce sex-linked chicks. This only entails keeping two separate pens. One of pure bred White Leghorns, both cocks and hens, the chickens from which are kept for crossing with the Brown Leghorn cocks in a separate pen. The White Leghorn cocks not required for breeding purposes could be fattened and killed and all

* See Chap. II for breeding instructions and explanation of heredity.

the pullets transferred, when old enough, to the pen with Brown Leghorn cocks, for the production of sex-linked chicks, either for sale or for keeping in a separate laying house as layers of eggs alone. It should be remembered that the hybrid Brown-White Leghorns should not be bred together as the sex-linked plumage characteristics are lost in the second generation and so is hybrid vigour.

In order to work this simple system for the production of sex-linked chicks the following organization is necessary. A breeding pen of White Leghorns, both cocks and hens. The pullets from this pen should be bred to Brown Leghorn cocks only, specially purchased of course, and the hybrid sex-linked hens kept separate in a third pen or laying house for laying purposes or sold as sex-linked chicks. You will thus get the benefits of sex-linkage with the least possible outlay as the number of Brown Leghorn cocks required will not be large.

At this point it is just as well to mention the number of cocks which will be required for breeding purposes. In close confinement and for the production of setting eggs only, the number of hens per cock should not exceed ten to a dozen. And in order to get eggs which are certain to be fertile and likely to produce vigorous chicks, young cocks and young pullets should not be bred together. Whenever possible, hens in their second laying season and onwards alone should be used for the production of hatching eggs, bred to cocks which are also two years old or over. As an emergency measure, which is not to be recommended as a routine, pullets in their first year may be mated to old roosters and young cocks may be mated to hens in their third laying season. However, it often happens that chicks which have come to full maturity die in the shells because they have insufficient stamina to break out of the eggs, and this state of affairs can be brought about by many causes, some of which are:—young cocks and pullets bred together, old or weak cocks, too many hens running with one cock, general debility or disease, or undernourishment of the flock. All these should be carefully guarded against. When flocks are kept at large in paddocks of very considerable area, one cock can be used for fifteen to twenty hens. Observation of the condition and behaviour of the hens will show whether there are

too few for the number of cocks, or in a small pen for a single cock. If the hens seem worried or uneasy or are losing the feathers from their backs it will be necessary either to increase the number of hens per pen or to separate the cock from the hens until about ten or eleven o'clock in the morning. For egg production pure and simple, when there is no intention of breeding, there is no necessity for any cocks at all and the laying hens and resultant eggs are all the better for their absence. But where eggs are required for breeding, whether by broody hens or in an incubator, cocks, and vigorous cocks at that, are an absolute necessity. I suggest a breeding pen of ten or twelve hens to one cock. It is safest not to use eggs for hatching until ten days after the cock and hens have been running together. Fertile eggs have, by experiment, been known to be produced four days after the cock has been turned into the pen, but not by any means in every case, and on the other hand, infertile eggs have materialized even a week after the cock joined the hens. Hens will continue to lay fertile eggs for ten days, or longer, after they are separated from a cock.

Pullets in their first year are usually the heaviest layers, lay fewer eggs in their second year and still fewer in their third. Only very exceptional birds go on laying after their third laying season and some are not worth keeping after their second. A sharp lookout should be kept on the laying flock and as soon as any bird ceases to lay sufficient eggs to pay for her keep she should be eliminated. It is calculated that it takes seventy eggs per year to pay for a hen's keep; if she is laying fewer eggs than this she is costing more than she is worth. A laying flock of a good breed and a modern strain should lay from three to four hundred eggs in their first three years and this should be the number to aim at, although there are such things as flocks which lay an average of 200 and even 300 eggs per bird per year.

With flocks kept merely for laying purposes and not breeding, it is naturally the object to get as many eggs as possible, but with hens kept for the production of hatching eggs the situation is rather different. The object here is to get the largest proportion of eggs which will produce live and vigorous chicks. Some very heavy egg layers seem to exhaust them-

selves by their egg-laying efforts and are liable to lay eggs which are either infertile or produce chicks lacking in stamina or even in some cases dead-in-the-shell chicks. Of course, it is hardly necessary to mention that hens of this description should not be admitted to the breeding pens. However, as when selecting for breeding purposes it is usual to select the highest egg layers in the hope of fixing a high egg laying strain, so it is precisely these birds which one would naturally select to breed from, other things being equal, and it is rather difficult to decide to discard one's best egg layers when it comes to selecting the breeding stock. The best thing here is to make a trial hatching under a broody hen of say a dozen eggs each from your best layers. If these eggs hatch lively healthy chickens, you are safe in continuing to breed from these hens; but if the chicks are unsatisfactory, your best hens must be kept for egg production and not used for breeding. Very often the hens which lay only a moderate number of eggs produce the healthiest and most vigorous chicks.

Although not likely to be obtainable in India the Minorca should do well and lays very large eggs. Campines and Houdans like a light soil which is found in many parts of India and are also good egg layers. None of the above light breeds are sitters and as they all mature early are not winter egg layers. They all come to maturity and begin to lay in about six months. If required for winter egg laying they should be hatched in April.

GENERAL PURPOSE BREEDS: As well as being about equally useful for egg laying and fattening for the table, these breeds are usually good winter layers, at which season eggs command their highest price, good sitters and mothers. For those who intend to hatch their eggs under a hen instead of using an incubator these will be the best breeds to keep. Actually laying tests have shown that carefully bred Rhode Island Reds and Wyandottes are just as heavy egg producers as the Leghorn as well as being heavier and better fleshed table birds. Rhode Island Reds, being exceptionally hardy and useful, are very largely kept all over the world and therefore are more easily procurable than other breeds. They require more space, but on the other hand they are much

larger birds and weigh from six to seven pounds. As they naturally eat more food they are not quite so economical to keep but have compensating advantages. They are good sitters and good mothers and can be used very successfully for small scale hatching. They mature later, in about eight months, and if hatched in March will commence laying in time for the winter season when eggs fetch the highest prices. Altogether they have many advantages. Rhode Island Reds also lay tinted eggs which are preferred by some people.

Wyandottes, both white and coloured, are also favourite general-purpose birds. Their chickens are hardy, fast growing, and fatten well. They are good layers of tinted eggs although these are not so large as those of some breeds. They will thrive on most soils.

Plymouth Rocks, of all colours, are also suitable for both laying and fattening. They are an American breed which is also very largely kept and should not be too difficult to procure. Barred Plymouth Rock hens crossed with any black cock of a pure breed, give sex-linked chicks in which the cockerels are all barred and the female chicks all black, a useful breed for sex-linked experiments. For this purpose *barred* Plymouth Rock hens are essential. They are hardy, good winter layers, and fatten well.

Orpingtons of all colours, black, buff, and white, are also a favourite and ornamental breed. Remarks about the above mentioned breeds are equally appropriate to the Orpington. Good winter layers, hardy late maturing, heavy bodies, easy fattening, good sitters and mothers, and heavy layers.

Langshans are another general-purpose breed which might be tried. They lay eggs of a particularly dark tint and have fine flesh on medium heavy bodies. They have all the general qualities of the above breeds.

As a guide to selection, all the abovementioned breeds lay large or medium large tinted eggs, are hardy, and suited to almost all soils and can be used for producing a hardy and more prolific hybrid by crossing. By judiciously choosing your breed, according to the table at the end of Chapter Two, you can combine the advantages of hybrid vigour with greater egg-production and sex-linkage. The general theory

of hybrid vigour is that by combining genes for high egg-production and other desirable qualities in any one breed, genes for vigour which have not been taken so much into consideration, are lost. But by crossing two pure breeds it may happen that the dominant genes necessary for vigour, lacking in one breed, are supplied by the other and in this manner hybrid vigour is achieved.

TABLE BREEDS: These are distinguished, among other things, by lightness of bone and heaviness of flesh, easy fattening, early maturing, delicacy of flesh of which a large part is on the breast, and heavy weight. They are mostly sitters and good mothers, but are not remarkable for the number of eggs they lay. Although there are several pure breeds which take first place where flesh-production is concerned, it has been found by experiment that crossing pure breeds produces an even better result. When the benefit of sex-determination at emergence from the shell is combined with this, the advantages of sex-linkage are obvious. In keeping table birds for fattening purpose the cockerels are separated from the pullets as soon as their sex can be distinguished and kept in a separate pen, where they are fed with the object of early maturity and fattening from the moment they are segregated. As in the case of sex-linked chickens this is as soon as they are hatched, this kind of chick can be dealt with much more easily than the other kind. The Sussex is one of the well tried table varieties and as there is both a Red Sussex and a Light Sussex, the Red Sussex cocks may be crossed with the Light Sussex hens to produce sex-linked chicks which exhibit all the advantages of the pure bred fowl with the addition of sex-linkage and hybrid vigour. After deciding what he wishes to keep his flock for, whether for egg-production pure and simple, general purpose, or merely for fattening for sale as table poultry, there is no reason why the budding poultry keeper should not select his stock in order to give him all the advantages which recent advances in the science of genetics place within his reach, especially if this can be done without too much trouble and the reading up of tough books on genetics and animal-breeding, which might only have the result of confusing his mind without helping him much.

SUSSEX: There are red, speckled, and light variants of this breed, all of which are about equal in merit. The only advantage in keeping more than one breed is that the Red Sussex can be crossed with the Light in order to obtain the advantages of sex-linkage and hybrid vigour without losing the chief characteristics of the breed which are, flesh of very fine white texture specially abundant on the breast, medium size of body with great capacity for fattening, and early maturity. They are only medium layers but hardy and vigorous.

DORKING: This is another famous English table breed with about the same qualities as the Sussex. It lays a medium number of large eggs. Crossed with the Indian Game, the Dorking produces a very large hybrid bird excellent for the table, but useless for any other purpose. The above two breeds do well on light gravelly soils.

INDIAN GAME: These, although large birds, are useless for table purposes as their flesh is too hard and they lay very few and small eggs. They are useful however for crossing with the soft fleshed breeds like Sussex and Dorking for the production of a large and rapidly maturing table fowl.

There is a very large choice of breeds from countries other than England, America, or Australia, but there is no object in producing a long catalogue of breeds which are very unlikely to be obtainable in India and would be no better for various purposes than the breeds already mentioned, which are more likely to be obtainable without importation. There is no useful object gained by keeping a variety of breeds at the same time. This merely leads to confusion and distracts the attention of the poultry keeper from the valuable characteristics of his flock. It is better to know one breed thoroughly than several superficially. By a very careful study of his birds the poultry keeper will be able to discard those which show no promise of improving his flock, and keep and breed from those birds which show the greatest hardiness, stamina, and egg-production. My advice to the beginner is to start with one breed, selected for the purpose in view, and stick to it. You will only incur a loss both of money and experience by constantly chopping and changing. By all means

keep a breeding flock of one pure breed and cocks only of another for the purpose of sex-linkage and hybrid vigour, but this is the limit to which any beginner should go. The backyard poultry keeper should content himself with one breed of hens, White Leghorns are recommended, and no cocks at all. He should either buy settings of eggs to hatch himself or young pullets ready to lay, and should not bother himself about breeding at all, for the very excellent reason that he is not likely to have the time to waste in making it a success. He is, or should be, a man of one idea. Getting something for nothing or as near as he can get to this very desirable ideal. If he confines himself to keeping half-a-dozen hens as advised, and no more, he will come very near to realizing his ambition.

The following breeds are available from the Government Poultry Breeding establishments in India. The addresses of these will be found useful by those seeking information on any matter relating to poultry keeping.

Poultry Research Section, Indian Veterinary Research Institution, Izatnagar :—High egg-laying strains of Rhode Island Reds and White Leghorns.

Mission Poultry Farm, Etah :—Specializes in Minorcas.

The Mission Agricultural Institute, Allahabad :—Can supply white Runner Ducks.

Other Poultry farms are as follows, but I have no information as to what breeds are available.

Government Poultry Farm, Hebbal, Bangalore.

Government Poultry Farm, Kirkee, Poona.

Government Poultry Farm, Tellikerry, Nagpur.

Government Poultry Farm, Dilkusha, Lucknow.

Government Poultry Farm, Gurdaspur.

Government Poultry Farm, Patna.

The rate charges at Izatnagar are: For a setting of fifteen hatching eggs, Rs. 10; White Leghorn or Rhode Island Red

pullets, Rs. 6 each; Rhode Island Red or White Leghorn cocks or cockerels, Rs. 15 each. I have no information as to what other Government of India Poultry Farms charge but the rates quoted above are probably standard or very nearly standard for all similar Institutes. In any case these prices are very much lower than the cost of imported birds.

CHAPTER VI

HATCHING

CHOICE OF EGGS: It is not every egg that will produce a healthy and robust live chick. Some chicks come to maturity in the egg, but have insufficient stamina to break through the shell, and it is no use helping the chick out of the shell because chickens thus helped nearly always die. If a chick has insufficient strength to break out of the shell it has also insufficient strength to survive. So all hatching eggs must be very carefully selected. You should reject all eggs showing the following abnormalities :

1. All those unusually large or small.
2. All misformed eggs, such as long and thin, spherical, or of any other unusual shape.
3. All those thin or rough shelled.

A misformed egg is pretty sure to hatch a misformed chick, and a very large egg does not necessarily produce a very large hen. It may have a double yolk and produce a monstrosity, which is useless.

As it is advisable not to use any eggs for hatching purposes which were laid by a hen in her first laying year, there will be a whole year in which to determine which of your hens are the best and most regular layers and to keep all eggs laid by these hens for hatching purposes. Second year eggs will be much more likely to hatch worthwhile chicks than first year eggs. The best layers and most healthy and active birds, carefully chosen after a close observation of their capabilities during the first laying year, should be segregated in a special breeding pen with a cock which has been selected with equal care, and all the best and freshest eggs kept for hatching.

The kind of hen which is likely to lay fertile and robust eggs suitable for hatching purposes is a lively and intelligent looking bird that exhibits the clean physique and hard muscles

of an athlete and is at all times active, alert and vigorous in her habits, energetically scratching, foraging, and running about always eager for food. An over-fed, stupid looking, and lazy bird is useless for breeding purposes. Every effort should be made to keep the breeding stock muscular and in hard condition by making them work for their food and thus take plenty of exercise in every way possible, especially if they are kept in a confined space.

Having selected your eggs with great care there are two ways of hatching them, by putting them under a broody hen and by means of an incubator. Each has its advantages and each will be treated separately; but here let me give my own personal experience which may not be that of all practical poultry keepers, although I expect it will. For Indian conditions and for breeding on anything except the backyard scale I consider the incubator indispensable. There are very good reasons for these and they will be given later.

WHAT HAPPENS IN A HATCHING EGG: The essential part of any hatching egg is the fertilized ovum from which actually the embryo chick develops. This is attached to and floats on the surface of the yolk, the function of which is merely to provide the nourishment from which the chick develops and from which all its bodily organs and feathers will develop without any further contributions from its mother, except heat. The yolk is surrounded by the white (albumen) of the egg and this in turn is protected by a strong membrane to which the shell is attached. Although the shell is sufficiently strong to protect the growing chick from injury and to insulate it from the outside world it is sufficiently porous to permit a continuous diffusion of gases inwards and outwards. There is a constant interchange of gases between the inside of the egg and the outside air, oxygen diffusing inwards, for the development of the chick, and water vapour and waste products diffusing outwards. It may seem to the reader that it is not necessary to know all this, but there are many factors which contribute to the successful hatching of eggs and also to failure. Without a reasonable knowledge of what goes on inside the egg during the longish process of hatching and of the functions and development of the various parts of the egg it is impossible to take

an intelligent interest in the complicated and delicately balanced process of chick development or to know the cause in case anything goes wrong and you fail to attain the expected result. If you know something about the internal structure of the egg and the delicate adjustment of its various parts, you will be able to avoid making mistakes which are bound to end in failure and also to trace mistakes when they have been made, which are inevitable with beginners, and avoid them in future. Without this knowledge these mistakes will mystify you and you will go on making them until, perhaps, you become disgusted with the whole business and give it up in despair. I shall not go deeply into the matter but shall confine myself to giving only that information which is of practical utility and shall be careful to mention why the information is given and how it can be used to ensure success.

Now, the porosity of the eggshell has very considerable importance. Besides oxygen diffusing inwards so do other and injurious gases. Fumes from the lamp of an incubator, dirt from broken eggs, and impurities from a contaminated atmosphere, all of which hinder development and may even cause the death of the chick. If there is an insufficient circulation of pure warm air the chick will not get sufficient oxygen for its proper development and will die. So the circulation of air in an incubator and a proper supply of fresh air to a sitting hen are of the greatest importance. Water also diffuses out of the egg and if it is not replaced the chick inside will dry up and die. The moral of this is that all incubators must have efficient humidifiers and they must be kept replenished with water during the whole period of incubation. Similarly the sitting hen must have a constant supply of water before her and in very dry weather, which is common in India, the space round her sitting box must be liberally sprinkled with water every day. Duck's eggs especially need so much water that they must actually be sprinkled with water slightly warmer than the temperature of the sitting hen every day. Porosity of the shell causes the water inside the egg to evaporate rapidly in very dry weather and if the eggs are kept too long before they are used for hatching so much water may have been lost as to make them useless for hatch-

ing purposes. These precautions are less urgent in the humid atmosphere of England but make all the difference between success and failure in India. Eggs for setting should not be kept longer than is absolutely necessary and if they are kept in a very dry atmosphere a pan of water, kept constantly filled, should be placed near them. Every effort should be made to keep setting eggs cool and uncontaminated until they are to be used. Dirty eggs should never be used for setting and if they become contaminated by neighbouring eggs being broken, all dirt must be immediately washed off with warm water and the egg replaced under the sitting hen.

Suspended by two cord-like attachments of the albumen the yolk has sufficient freedom of movement to ensure that the germ (ovum) always floats to the top in whatever position the egg may lie. This is in order that it may always be in contact with that part of the shell which touches the hen's body and thereby get the most heat. If the hatching eggs are left in the same position during the whole period of incubation, without being turned, the germ is likely to become attached permanently to the eggshell and the chick will die in the shell. A chicken's head always develops in that part of the egg which is highest, that is why eggs are smaller at one end than at the other in order that the larger end may always be uppermost. But under artificial conditions this is not always the case and care must be taken, whether the eggs are being hatched under a hen or in an incubator, that the larger ends of all eggs are higher than the small ends. From these remarks it will be apparent that a great many very small details contribute to the success or failure of hatching and inattention to any one of these small, and seemingly insignificant, details may lead to the loss of a whole setting of valuable eggs. However, if the poultry keeper is forewarned and attends to these essentials as a matter of routine the probabilities of loss are very materially lessened. But the poultry man must know precisely what he is doing and why he is doing it.

From the moment that the nucleus of the egg begins to be influenced by the heat of the hen's body, which is maintained at a temperature of between 103° F. and 104° F.,

changes commence to take place within the egg and are noticeable by the naked eye within twenty-four hours.

This has an important bearing on the keeping of setting eggs in India and also on their treatment during transit. Although in England the air temperature never rises above 104° F., in India it does, especially in the confined space of a railway waggon. If the temperature of setting eggs is allowed to rise to 104° F. or above, the germ may commence to develop and as it will not find the necessary conditions of even temperature and humidity necessary for normal development, that development will very soon be arrested, the keeping qualities of the egg will be destroyed, and the egg will become addled. This accounts for the badness of a good many Indian eggs and their failure to develop into chickens. Setting eggs should be stored in as cool a place as possible; 60° F. is the temperature recommended in England but in India it is unattainable, in most places and at most times of the year, without refrigeration. So setting eggs should be kept as cool as possible and used with the least possible delay.

At first a small spot develops on the surface of the yolk, surrounded by a network of blood vessels which gradually spreads over the whole surface of the yolk and draws nourishment from it for the development of the growing chick. When the chick is fully developed and ready to leave the shell all the yolk has been absorbed, but part of it still remains in the stomach of the little bird and provides sufficient nourishment for, at least, the first twenty-four hours. The significance of this is that newly hatched chicks do not need any food for the first twenty-four hours, and probably the first forty-eight hours of life, and should not be fed until they are at least one day old. However, they require, and will pick up, fine grit from the very first hours and will also need water.

If there is any doubt concerning the fertility of the eggs which are being hatched they can be tested for fertility by holding them between the eye and a bright light, care being taken to ensure that all light except that which passes through the eggs is screened from the eye by the hand or a piece of

cardboard with an oval hole cut in it. Any light will do but that from an electric torch is most convenient. The handle of the torch may be passed through a hole in the top of a box, where it will be held in a vertical position by its larger head. The eggs can then be examined by holding them against a hole in thick piece of paper, about the same size as an egg, laid on the top of the torch. If, after seven-day incubation, the egg is still perfectly clear it is unfertile and should be rejected. If the whole of the yolk is seen as a vaguely dark mass it is addled and should also be thrown away. If, in an otherwise clear yolk, a dark spot is seen, surrounded by a circular area of veins, which will be seen as a shaded area darker near the spot and fainter further from it, the egg is fertile and has begun to develop. It should be returned to the hen or incubator as soon as possible. Further stages in the development of the chicken do not concern us and we will go on to a discussion of more practical matters.

THE MANAGEMENT OF SITTING HENS: Innumerable Indian housewives produce perfectly good broods of chicks with the most primitive apparatus, a simple basket or box placed in some dark corner, lined with soft grass or just merely dry earth. When the chicks are hatched they are allowed to run about freely with their mother in some open courtyard or even in the village street. This is a nice easy way of doing things but the infant mortality is terrific, as may be seen by the small broods which usually follow the village *murghi*. With settings of valuable eggs from pure bred poultry this is not recommended although, of course, some kind of results can be, and are, actually obtained. However, if reasonable efficiency is aimed at the job should be undertaken in a well thought out and systematic manner, all foreseeable contingencies being provided against.

The greatest drawback to the successful hatching of chickens in India, or any tropical country, is vermin. More hens abandon their eggs through being overrun with vermin than from any other cause, so every precaution to guard against this cause of failure should be taken. A covered nesting box, with a wire front and bottom, about sixteen inches square and the same in height should be provided. Some holes, one

inch in diameter, near the top will provide sufficient ventilation, which is very important. The front should be hinged or pivoted at the bottom so that it can be let down and give free access and exit to the hen when she wishes to leave her nest. I do not think hay or straw of any kind is a good thing in India, as anything of that kind breeds lice and the only thing to be done when the straw is infested with lice is to remove and burn it which disturbs the hen and makes her abandon the nest. The nest box should either be placed in some special shed or other place which will be undisturbed most of the day and is fairly dark but well ventilated and not too hot. The bottom of the box, to a depth of about three inches, should be covered with a mixture of fine dry earth and ashes, with a shallow depression scooped in the middle for the eggs. Care should be taken to fill the corners of the box with earth or the eggs will roll into the corners and will be out of reach of the hen's bodily heat, where they will get addled. Over the surface of the earth and ashes sprinkle a liberal quantity of finely powdered sulphur or sodium chloride, if obtainable. The whole of the inside and outside of the sitting box should be sprayed with DDT dissolved in paraffin, any commercial brand. However, do not spray the surface of the earth and ashes where the eggs are going to lie, because if you do some DDT might find its way through the pores of the shell and kill the chick. DDT must be used with discretion although it is a splendid weapon against insects of all kinds. Your broody hen should be sprayed with DDT under her wings, where there are no feathers, and after her feathers have been turned back, at the roots of all the feathers except those which come in contact with the eggs. After this she should be dusted, also under the feathers, with DDT and talcum powder and left to sit on some artificial eggs for two or three days in order to make certain that she has settled permanently down to broodiness. When you are satisfied that she is going to sit steadily the artificial eggs are removed and the real eggs substituted. If you do not take every precaution that ingenuity can suggest against lice and other vermin, you are very unlikely to get a brood of chickens. In most probability you will lose the whole of your setting of eggs and waste your time and money for nothing.

Even if you have a flock of pure bred fowls, it is not necessary to use them for hatching purposes and therefore waste their high egg-laying capabilities. The ordinary village hen will act just as well and in most probability make a much better and more efficient mother. The number of eggs to place under a hen depends on the size of the hen. The average Indian hen should not be given more than ten, or a dozen at most in the hotter parts of India; in the colder parts the number should not exceed ten, although I have known people to try twenty where I only ventured to put ten. They were, of course, surprised and hurt because they only got about three chicks and I got ten. A large English hen can be entrusted with a full dozen but not more if you expect a successful hatch of the full number of eggs.

FOOD AND DRINK: As sitting hens have to generate a considerable amount of heat, in the cold parts of India they should be given grains like maize and wheat; in the warmer parts of India the normal heat of the hen's body is about the same as that of the atmosphere and she has not so much difference to make up and any hard grain will do. As hard grains are digested more slowly than soft mash and the hen does not leave her nest more than once a day to feed, she should be given hard grain alone when sitting, but as soon as the chicks are hatched she may be given a nice nourishing feed of soft mash to help build up her strength, and after the first day mash once a day and hard grain once, just like any other hens. In a hot climate like India any sitting hen needs to drink a great deal of water, both to quench her own thirst and also to provide moisture for her eggs. A vessel of water should be within her reach all day without necessitating her leaving the nest. Food may either be left in a dish near the nest all day or the hen may be fed at regular hours every morning, when she leaves her nest to cool her eggs and have a dust bath. If a hen refuses to leave the nest at the usual morning hour she should be gently lifted off, care being taken that no eggs are lifted with her under the wings, and allowed to peck her grain and take a little exercise. In a hot climate a hen can leave her eggs for half an hour to one hour without any damage to them, so there is ample time for the sitting hen to take a dust

bath or to do anything else she pleases, and she should not be hurried back to her eggs.

DUST BATH: As sitting hens have to sit steadily without movement and without any opportunity to rid themselves of lice or other vermin except when they are off the nest, vermin breed apace on them and unless they are given ample opportunity of using a dust bath every day or as often as they wish to, they will get so covered with lice that they will no longer be able to stand the intolerable torment and will abandon their nests. So it is most important that all sitting hens should have immediate access to an efficient dust bath of fine ashes. This should be placed in the same shed as the sitting box and within easy reach. Should a hen get so covered with lice that she leaves her eggs within a few days of hatching, the eggs, freed of lice, can either be given to another hen or placed in the kitchen in a basket with a thermometer among the eggs and kept at a temperature of 104°F . until the eggs hatch. If they are covered at night with a light quilt or several folds of a light woollen blanket and placed near a fire in which the ashes have been well raked together with some still glowing coals under them, the heat will last all night and there will be a good chance of the eggs being saved. They should be covered for part of the day with a slightly damp cloth, rung out in water slightly over 104°F . No guarantee is given that this expedient will work every time, but it has worked with perfect success on several occasions when tried by me.

When the hen is off the nest, the sitting box should be examined for lice. If any are seen running about it is a sign that they are breeding too rapidly and the hen should be sprayed with DDT, very gently without disturbing her too much, and the eggs and hen shifted to another sitting box. There is, of course, a risk of making your hen abandon her eggs, but not if the whole thing is managed quietly and without fuss. On the other hand, if you do not do something your hen is going to forsake her nest anyhow. The first thing to do is to get another sitting box ready and place it next to the one already occupied. Then, when the hen is off the nest, the eggs should be transferred to the new box and the old one removed, to be disinfected. The

hen will then quite quietly walk into her new box without knowing anything about the change. The next day she should be gently examined for lice and, if necessary, sprayed. I need hardly say that the new sitting box should be liberally sprayed with DDT before the new nest is made in it and the eggs transferred.

In my opinion, the greatest disadvantage of natural hatching with broody hens is this question of lice and other vermin. They cannot be eliminated entirely however careful you are, and there is always the risk that they will increase in spite of every precaution, to the extent of making the hen abandon her eggs. If she eventually hatches her chicks successfully they are bound to get infested immediately and this will seriously affect their growth and health. With an incubator and the most moderate precautions, on the other hand, chicks can be hatched without a single louse and kept free from vermin infestation for weeks or until they are turned loose with other birds. This is an enormous advantage, and give the little chicks a good healthy start in life.

When the chicks hatch, leave them to the care of their mother and do not attempt to move them until they are at least twenty-four hours old. Eggshells should be removed as soon as vacated but otherwise no attention is necessary. As soon as the hen and her chicks are removed to a coop, the chicks should be provided with a shallow tin full of fine grit and another of clean water. They need grit before they are given their first meal and if they are allowed to eat before they have swallowed some grit they will die through being unable to digest the food they have eaten.

CHAPTER VII

INCUBATOR HATCHING

IF you compare the number of broody hens required to hatch say 150 eggs, with the necessary sitting boxes, coops, and space required, not to mention the trouble and expense of feeding, supervising, and keeping them clear of vermin, with the comparative simplicity and cheapness of running a 150-eggs incubator, the immense advantages of the incubator over the hen, especially for busy persons, will be immediately apparent. In order to hatch 150 eggs, at least a dozen broody hens would be required. This implies at least fifteen sitting boxes, three spare in case they become infested with lice, another dozen coops and all the feeding utensils, water troughs, dust baths, and other paraphernalia incidental to maintaining a dozen broody hens. A sitting house of considerable area and cost would also be necessary and a very large space of grass for the coops to be placed on and later for the hens and their broods to range over. All the time, until the chicks are full grown and can look after themselves, you must be constantly on the look out for vermin infestation, rats, cats, jackals, thieves and other marauders. The possibilities of loss are immense and a poultryman would be very lucky to rear to maturity even half the chicks originally hatched.

Compare this with the comparative simplicity of hatching and raising the same number of chickens in an incubator. A single 150-eggs incubator, which would take about the same space as an ordinary kitchen table, would hatch all the 150 chicks, and do it much more efficiently than a dozen of even the very best hens. There would be no danger of vermin infestation and your young chicks would start life entirely free from this menace to their health and stamina. The feeding, watering, and general supervision of a dozen hens is replaced by simple attention to a single incubator, which only requires about half an hour's attention a day

and is otherwise entirely automatic. Some incubators, like the Gloucester, are provided with a lamp container which will hold sufficient oil to last for three weeks, the whole incubating period, so that it has to be filled only once for each batch of chicks hatched. There is no filling of lamps and trimming of wicks to be done until the chicks are hatched and the incubator has to be made ready for another batch. This is a very great convenience. Eggs, of course, have to be turned every day, but as all modern incubators are fitted with self-turning trays this can be done in a matter of seconds. Taking everything into consideration the advantages of incubator hatching are overwhelming and make the chances of success and profit much more certain.

Selection of suitable eggs and care in storing them apply just as forcibly to eggs destined to be hatched in an incubator as eggs to be placed under broody hens. The same principles will apply as those mentioned in the last chapter dealing with setting eggs for natural incubation.

SELECTION OF INCUBATOR: So far as I know there are no incubators manufactured in India and any poultry keeper intending to use one will be compelled to import it from England or America, so he will be able to choose an absolutely up-to-date machine with all the latest improvements, for which spare parts, if necessary, will always be available. In my opinion, it is far better to start with a brand new machine. Incubators are fitted with very delicate automatic regulating devices and are scientifically designed instruments which will not stand rough treatment or neglect. If you are tempted to buy a secondhand incubator the chances are that it is being sold off because the former owner has damaged it so badly that it will no longer work and you will be put to endless loss and annoyance before you find out what is the matter with it and put it right. You must remember that there is probably no one in India who understands the repair and adjustment of incubators and you will be entirely dependent on your own knowledge and resources, which may be nil. On the other hand a new incubator in perfect working order is simplicity itself to work and can be managed by a child.

No useful purpose would be served by describing all the different makes of incubators on the market. If you deal with an old established and experienced manufacturer with a reputation to maintain, you will be certain to get a well designed and soundly constructed article which will be a cause of pride and profit. Considering the work they do and the skill and knowledge required in their construction, and the profit they are capable of producing, incubators are not expensive machines and the difference in cost between the best and the worst is not worth considering. So when you buy, get the best.

Incubators are of various types: those working on the hot air and those working on the hot water principle. In the hot water type, over the eggs tray there is a large water tank through which the flue of the lamp passes, thus keeping the water at the correct temperature and providing heat from above the eggs, just as in natural incubation. All incubators are fitted with a very delicately adjusted heat regulating device which generally consists of a capsule over the egg chamber which expands when the temperature rises above 104° F. and pushes up a rod which in turn lifts one end of a long lever, provided with a sliding weight, at the end of which is a cap which opens the top of the lamp chimney. This allows the heat from the lamp to pass directly out of the chimney instead of circulating round the flue above the egg chamber, thus lowering the temperature. When the temperature falls so does the cap, closing the chimney and allowing the hot air to circulate round the flue, raising the temperature again. When the incubator has got properly warmed up and the eggs have all arrived at the incubation temperature the lever takes up a position, without rising or falling perceptibly, which maintains the eggs at the correct temperature.

Every incubator is fitted with a thermometer, projecting from the egg tray, which can be read from the outside. This thermometer is usually provided with a clearly visible red mark at the correct temperature and if the incubator is running slightly too hot or too cold, the sliding weight on the long lever above the incubator forms a very easily manipulated fine adjustment for keeping the temperature exact. The

regulation of temperature is simplicity itself and is very soon learned. Elaborate and carefully written instructions, explaining all the special features of each type, are sent out with each machine and if these are carefully and systematically followed, successful working is assured.

All incubators have a warming tray under the eggs chamber, in which the newly hatched chicks are placed as soon as they are out of the shell, in order that they may be kept at the exactly correct temperature until they are dry and their fluffy down takes up its normal position ready to protect them from variations in temperature. Hot water incubators are somewhat more expensive than the hot air type on account of the extra cost of the hot water tank. They have special advantages for cold climates because of the large reserve of heat held by the considerable volume of hot water in the tank and they are supposed to be the best type for the hatching of duck's eggs. The Hearson Incubator is a world famous make and typical of the hot water type.

Hot air incubators have practically the same regulating devices as the hot water type, but instead of the hot water tank radiating its heat downwards over the eggs, in the hot air type there is a constant circulation of hot moist air downwards and through the eggs. Hot air incubators are slightly less complicated than the hot water type and also lighter. The Gloucester Incubator is typical of the hot air type and is made by a long established firm of repute. All incubators, whether hot water or hot air, can be fitted on request and at a slight extra cost, with self-turning trays. These are a great convenience and time savers as anyone who has had to turn 150 eggs every morning for three weeks will understand. Any poultryman contemplating the use of incubators should specify self-turning trays. The Gloucester has another time saving feature which is most convenient. It is fitted with a glass front through which the eggs, and hatching chicks, can be watched without opening the machine. The lower drawer for warming the newly hatched chicks extends right to the front of the machine but the upper eggs tray does not, a space being left between the eggs tray and the glass front. When the chicks hatch and are able to move,

they struggle towards the light and drop the short distance into the warming tray below, where they remain with plenty of room and free from eggshell until they are ready for removal to the brooder. In most other incubators the chicks have to be transferred from the eggs tray to the warming tray below by hand. But in the Gloucester they transfer themselves without any trouble or anxiety on the part of the operator. I have used Gloucester incubators with great success. It has also a good humidifier.

CHOOSING AN INCUBATOR FOR INDIAN CONDITIONS: Some conditions met with in India do not apply to temperate countries and an incubator which is best for say English conditions is not necessarily best for India. One of the nuisances of India is ants. They sometimes consider that the conditions inside an incubator are as ideal for their eggs as they are for hen's eggs and proceed to deposit them in large numbers. They can be a pestilential nuisance. For this reason I consider that an incubator which stands well off the ground on its own legs is the best type for India. The legs should be put into tins kept filled with water and some disinfectant in order to prevent ants and other insects from using the congenial conditions of the incubator for their own convenience. Provided that your incubator can be easily insulated from ant infestation there is not much to choose between the various types.

The best thing to do is to send for catalogues and study the various types offered, choosing one which suits your own particular requirements. Makers of incubators are also makers of brooders and other apparatus for chick raising and a very great deal of useful information will be gleaned from their catalogues. You may decide that the incubator of one maker suits your requirements but that you prefer the brooders of another and so forth. Where the chances of loss due to a cheap or faulty piece of apparatus are so great the best is the cheapest in the long run. Buy from a long established maker of repute and you will always be certain of getting spares and replacements when you require them. If you wish to add to your equipment you will also be able to get another incubator identical with the one you have already found satisfactory.

SIZE OF INCUBATORS: If you are keeping poultry on any kind of scale, except backyard, the trouble and expense of looking after small incubators is not worthwhile. It takes just as much time to look after an incubator capable of hatching fifty eggs as it does to look after one which will hatch four times as many and the price of the larger incubator is not anything like as much as four times the price of the smaller. Also small incubators have no flexibility to speak of. With a 150 or 200-eggs incubator you are not compelled to hatch the full number of chicks if it is not convenient to do so. A 150-eggs incubator will hatch 50 eggs just as well as the full number, but with a 50-eggs incubator you are limited to 50 or less. So I advise the large scale poultry breeder to buy a 150-eggs incubator as the smallest practical size. There is another important point. If you intend to experiment with the breeding of ducks, which is much easier than breeding chicks, you should order an incubator with tray or trays for duck's eggs. As a duck's egg is slightly larger than a hen's egg the trays for duck's eggs have slightly larger compartments for the larger eggs. A duck's egg tray will take hen's eggs but a hen's egg tray will not always take duck's eggs. By ordering for duck's eggs you make sure that you can hatch either as you wish. In any case do not forget to order self-turning trays; this will save you any amount of time and trouble.

STARTING THE INCUBATOR: Unless you go about the management of your incubator, or incubators, in a systematic manner you will get tied up in knots and give yourself any amount of extra trouble. Whereas, if you do everything with well considered order and system your poultry farm will almost run itself as far as incubators are concerned. First consider what day of the week it would be most convenient for you to have your chickens hatched. Say you have most spare time to devote to chicks on Saturdays and Sundays. You will then find it most convenient for your chicks to begin appearing from the eggs some time on Friday, so that they may almost all be out by Saturday morning and ready to be transferred to their brooder the same day, the two days on which you have most leisure. It takes exactly three weeks for a chick to be incubated, that

is twenty-one days. If you start your batch of eggs on a Saturday, a day on which you will have plenty of time to devote to the job, your chicks will begin to hatch on Friday three weeks hence. By Saturday morning they should be all out of their shells and ready to be transferred. If you wish to make the utmost use of your incubator you will immediately clean it out, scrub it with disinfectant, fill the lamp and have it ready to be refilled with eggs on Saturday evening, to produce another batch of chicks on Friday three weeks hence. By having three incubators going simultaneously, and filling each one on a Saturday, you will be able to ensure a constant supply of chicks regularly every Friday in the month. Actually you will find that all, or nearly all, your chicks are out of their shells and ready for transfer from the incubator on Friday evening, leaving you the whole of Saturday to clean and fill your incubator. The chicks will not need feeding the first day, but only need grit and water, so you will have the whole of Sunday to attend to them and see them well started in life. If you are inclined to try the day-old chick business on a small scale, this is the best way to do it. You will be able to offer day-old chicks on Fridays, Saturdays or Sundays as a regular weekly delivery, just on the days when the majority of persons have the most time to devote to looking after chickens or hens.

If you are starting a new incubator, light up the lamp and get it going at least three days before you intend to put the eggs into it. You will then be able to regulate it to a steady temperature before the eggs are put in, and thus ensure a fair start. When refilling an incubator after a batch of chicks has been removed, take out all the broken shells, brush out the whole incubator carefully and scrub everything inside with disinfectant before putting another charge of eggs into it. You will thus insure a sturdy batch of chicks free from infection and disease.

GENERAL RUNNING: Once the incubator is filled with eggs, as has already been explained, and the temperature has been regulated, the incubator will run itself except for the daily cooling of the eggs. This cooling and turning should be done at the same hour every morning. The eggs tray is removed from the machine and placed on a table

while its egg turning mechanism, whatever it may be, is manipulated. It is a good thing to mark each egg conspicuously on one side with a brush dipped in Indian ink, so that you can satisfy yourself that every egg has made one half turn onto its other side. If some have not completely turned they must be adjusted by hand. In putting eggs into the tray, which generally has a canvas bottom, be sure that all the eggs lie with their large ends higher than the small ends, or you will find the chicks developing with their heads at the smaller end of the egg, which is abnormal, and will have difficulty in making their way out.

COOLING: As a rule, the instructions accompanying the incubator give the cooling time as from fifteen to twenty minutes. This applies, of course, to temperate climates such as that found in England. In India, half an hour is none too long because in most places, especially in the hot weather, the outside temperature will not be much lower than that inside the incubator. Generally speaking, the hotter the weather the longer the time of cooling. While cooling the eggs should not be subjected to a draft, as under a fan, for instance.

If the particular incubator you are using is not fitted with a lamp large enough to last the whole term of three weeks without requiring a refill of oil, the lamp must be regularly filled and attended to and the humidifier, whatever type it may be, kept filled with water according to the instructions which come with the incubator.

INCUBATOR HOUSE: If you are going to use more than one machine it would be best to build a special incubator house. This should be large enough to leave plenty of space round each incubator. The roof should be high and substantial, certainly not of corrugated iron, in order that the house may be as cool as possible, with no drafts and little vibration. The incubator must be stood level and if it is on an earthen floor, as well as being dead level, made so by a spirit level if necessary, its legs should be protected against white ants (termites) by vessels of water; this will be a protection against the other kinds of ants as well. My incubator house was twenty-four feet long by twelve wide, with a

high roof and a cement floor, carefully laid level. The whole of one side above the height of four feet to the eaves was closed in with half-inch wire netting and nothing else. This was for the purpose of securing ample ventilation and acted very well. The walls were of double asbestos cement sheets, one layer outside and one inside, and the whole house was made rat proof. The open spaces at the eaves and at the ends, left for ventilation, were proofed with half-inch wire netting. At the bottom of the door, which was very substantial and a good fit all round, there was a six-inch board fitted close against the inside of the door, which one had to step over. This will prevent rats from getting in by gnawing away the lower edge of the door. This house and others like it proved quite satisfactory and rat proof.

Failing a special incubator house your machine must be placed in some well ventilated room having the desired conditions, it doesn't much matter where. But plenty of air, good ventilation, and freedom from drafts are essential, as well as freedom from rats.

WHEN THE CHICKS HATCH: Long before the chicks are due the brooder they are going to be transferred to must be got ready. In the northern parts of India where there is a cold winter, brooders with lamp heating will be necessary, but in the warmer parts, fireless brooders will be quite adequate. When opening the incubators on the last day of incubation, of which a careful record should be kept, the eggs will begin to show cracks at their upper ends where the chicks have begun to peck away a circle from the inside, large enough to permit them to struggle out. And make no mistake, it is a very severe struggle that the chick has to make in order to get clear of its shell. The poor little thing gets completely exhausted and is compelled to take spells of rest. They should not be disturbed, but as they struggle clear they should be removed gently to the drying drawer and all shells removed as vacated. No attempt should be made to help weakly chicks from their shells. You will probably injure the chick in trying to help and a chick that cannot escape from the shell by its own efforts will die anyhow. When the chicks are thoroughly dry and lively they should be shifted to a previously warmed brooder, if in a

cool climate, a brooder placed in a sunny spot if in a warm. This work should be commenced in the morning and not in the evening. You will then have the whole day in which to watch the behaviour of your chicks and see that they are properly trained in the use of the particular brooder you decide to buy. They must be shut in at night and you must make certain that the brooder is definitely rat-proof, otherwise you are likely to find not a single chick alive in the morning. I shall discuss how to deal with rats in another chapter. Grit of a very fine kind and fresh water should be provided from the very first. It is most important to make certain that the chicks have picked up plenty of grit before they are given their first meal. Otherwise they will mysteriously die, apparently from no cause whatever.

INSTRUCTIONS: Read carefully several times the instructions provided by the manufacturer of your incubator and make experiments with your machine to make certain you know how to work it and till you are familiar with its manipulation, before you put any eggs into it. Some makers recommend that eggs should be turned twice a day. Follow the rules carefully.

Remember that you are not compelled to fill your incubator completely with eggs the first time. You need only put a dozen eggs or so into it until you have hatched your first batch and know exactly what to do and how to do it. It is not a bad idea to put a couple of dozen chicks under a broody hen, at night, and let her look after them. The same may be done with a whole incubator full of eggs if you have the necessary number of broody hens handy—two dozen chickens to each hen. Do not try to persuade a broody hen to accept chicks not her own during the hours of daylight; she will only peck at them and refuse to take any interest in them. The same applies to a hen with a brood of her own; if you want to give her additional chicks this must be done after dark or she will kill the new chicks.

THE FIRST FEED: I shall go fully into the matter of rearing in another chapter in which feeding will be fully treated, so here I shall only explain feeding on the first day. After a period of twenty-four hours, during which

they have been provided with plenty of grit and clean fresh water, the chicks may be given their first meal of chopped hard boiled eggs. They must be fed small quantities every two hours, and alternate meals of hard boiled eggs and bread and milk may be given. After the first day, I consider the best chick feed to be Spratts "Chicko" which is obtainable in sealed tins. Alternate meals of "Chicko" and bread and milk may be given. Even the smallest chicks will greedily peck green food and lettuce so some tender green leaves should be hung, just clear of the ground, which they can peck at all day. Bread and milk should not be given soppy; the milk should be squeezed out of the bread until it is nearly dry. Soppy stuff is liable to give diarrhoea to the chicks.

CHAPTER VIII

DAY-OLD CHICKS

IN countries where poultry raising is highly developed, individual poultry keepers as a rule specialize in one branch of the business. For instance egg-production, fattening, breeding, or the production of day-old chicks, and each makes use of the products of the other specialist to some extent. Thus a man who is specializing in egg-production or in fattening will not bother himself with the breeding and incubating of his stock but will buy day-old or other chickens from some other individual who specializes in this business, confining his attention to that part in which he is particularly expert. In India this cannot be done because poultry keeping is by no means highly developed, and the prospective poultry keeper must be a self-contained unit carrying out all operations himself, and this makes his task much more difficult.

This day-old chick business is a case in point. In most countries where fowls are kept on a large scale by numerous specialists, the man who wishes to develop the day-old chick business would purchase his eggs from others and confine his attention to the incubation and despatch of his day-old chicks. In India not only will he have to do this but he will be compelled to produce his own hatching eggs, which is really a different branch of the job.

To make real money out of day-old chicks, they must be hatched on a fairly large scale, say at least 10,000 chicks per year. In England the demand for these chickens extends from about January to June, but as most parts of India have no real winter there is no reason why there should not be an all-the-year-round demand. As the selling of day-old chicks has not been developed in India yet, it might take poultry keepers some time to wake up to the advantages of buying their stock of hens or cockerels, as the case may be from others instead of endeavouring to breed them. On

the other hand, anyone commencing this specialized branch of poultry raising would have the field practically to himself until others woke up to the fact that it is a profitable proposition, but by that time he would have obtained a good start and a great deal of valuable experience.

In England the demand for day-old chicks is mostly from small scale poultry keepers, such as backyarders, who do not wish to be troubled with breeding and incubating or who have not the necessary space to undertake it. In India these would also probably be the people who would be most interested and their requirements would have to be studied before launching out into business. As backyarders mostly keep poultry for the eggs they lay, the demand would probably be for egg-laying strains such as the Leghorn. However, as larger breeds such as Rhode Island Reds, Rooks, Orpingtons, and Wyandottes lay nearly as many eggs as a Leghorn and are also better table birds their merits should also be considered. So also should the very real advantages of selling cross-bred chicks which are far more vigorous than the pure breeds, and as well as hatching out a larger percentage of live and healthy chicks stand transportation much better.

What breed is selected will largely depend on the breeds which are popular in the district or city in which it is proposed to start. If there are many poultry keepers in the neighbourhood who all keep the same breed they will naturally wish to purchase day-old chicks of the same breed. With a good deal of careful organization it may also be possible to form a local poultry association and make arrangements to buy setting eggs instead of having to keep a large flock of birds in order to ensure a regular supply of eggs just when they are required, which is most important if the plant of incubators is to be kept working at full efficiency.

If careful enquiry in the immediate neighbourhood reveals that a demand for a 500 day-old chicks per week is assured or can be worked upto, the business might turn out to be a profitable one. However, a warning must be given here. It is very unlikely that live chicks could be sent by rail with reasonable safety in India, although it is done regularly in America and all European countries. The demand must

therefore be a purely local one, in some large town or district, to which deliveries can be made by hand through the medium of some experienced employee of the chick-rearing firm, who will have an interest in delivering the birds alive and in good condition. It will be seen therefore that the day old chick business is likely to be a success only in the larger towns and cities of India.

In order to furnish the requisite number of eggs for a day-old chick business on a remunerative scale, say 10,000 chicks per year, if it is found impossible to buy 600 eggs per week of the required breed, it will be necessary to keep between four and five hundred birds to provide a constant and certain supply of eggs. Of course, the surplus eggs can be sold to others for hatching under broody hens or for eating purposes. As the whole success of the day-old chick business depends on the supply of hardy vigorous chicks in good condition it is of the utmost importance that all eggs destined for incubation should come from hardy, healthy, and vigorous breeding stock, whether they are bred by the day-old chick breeder himself or purchased from outside sources. Hens kept for the purpose of producing eggs to be incubated cannot be kept in confinement on the intensive system. They must have ample free range and lead an exceptionally healthy life outdoors, where they can get ample exercise and a continuous supply of green and insect food. Any attempt to incubate eggs laid by hens kept in confinement is doomed to failure from the start.

KIND OF BREED TO KEEP: As Leghorns are a popular breed and well suited to the needs of the suburban poultry keepers this is probably the safest breed to make a start with. If it is intended to supply sex-linked chicks with hybrid vigour it will be necessary to keep cocks of some coloured Leghorn breed, such as Black, Brown, or Partridge Leghorns and breed them with pure White Leghorn hens. This would give a breed which is still Leghorn and preserves all the heavy egg-producing characteristics of the breed together with the additional advantages of sex-linkage and hybrid vigour. The same result can be achieved with other breeds, such as crossing a Golden Wyandotte cock with White or Silver Wyandotte hens or a Rhode Island Red cock

with White Wyandotte or White Orpington hens. There is a wide choice. The important points to remember are that sufficient hens must be kept to give a regular and uninterrupted supply of 600 eggs per week, and that they must be kept under the healthiest of outdoor and free range conditions.

MANAGEMENT OF INCUBATORS: In order to get the maximum efficiency and value out of incubators and to ensure a regular and evenly spaced supply of day-old chicks, instead of a tremendous glut of young chicks, at long intervals, which may be impossible to get rid of during the short space of time when they can be safely transported. This only amounts to three days at most. A certain number of incubators must be started each week in a perfectly orderly and systematic manner and all preparations made well in advance, both to deal with the newly hatched chicks without delay, as well as to find purchasers for them long before they are hatched. All this requires a considerable amount of care, foresight, and organization, without which the whole business is bound to end in failure. There is no time to dilly-dally where day-old chicks are concerned. General precautions to be observed in the management of incubators have been dealt with in the last chapter, so it now only remains to describe the particular kind of organization required for the day-old chick business.

As a general rule I consider that it is best to start incubators always on the same day of the week in order to make certain that an orderly routine of work is made possible and a supply of chicks is available regularly each week on the same day, approximately. Your customers will then be able to depend on getting their chicks on the day of the week which is most convenient to them. They will appreciate this act of consideration on your part and be grateful for it. You must therefore be careful to find out which particular day suits your customers best. This will probably be either Saturday or Sunday, and so you will therefore start your incubators regularly every Saturday in order that the chicks are hatched on a Friday, three weeks hence. You will then have exactly the same kind of work to do, with almost mathematical precision, on the same day each week and

will soon get into a steady and orderly routine which will greatly facilitate your work and enable you to make out a regular time-table.

As you will know precisely on what day of the week to expect your chicks you will be able to make complete arrangements for getting rid of them in the shortest possible time without delay or confusion. Just try to picture to yourself the trouble and anxiety which would result if you started all your incubators on the same day and instead of having only say 500 chicks to deal with you had 1500, and then a long delay of three weeks before another batch was due. By starting a certain number of incubators every week, you certainly have three or four very busy days each week, but once your incubators are sterilized and refilled and your chicks disposed of you will have about three comparatively slack days in which to make your preparations for dealing with the next batch. In order to avoid confusion on the day of hatching, all preparations should be made well in advance for getting rid of the whole batch. This will entail advertising your chicks for sale, registering orders, getting boxes ready, and making preparations for prompt delivery. If you were expecting your chicks to hatch on Friday you will have had the whole of Tuesday, Wednesday, and Thursday to get ready for them. This should give you ample time to make adequate preparations.

NUMBER OF INCUBATORS: We are presuming that the season when demand is heaviest is during the twenty weeks between January and June and that during this period it is proposed to hatch 500 chicks each week. As there are pretty certain to be some chicks dead-in-the-shell it will be advisable to get not less than 600 eggs in your incubators as this will allow for 100 eggs which do not hatch. In order to hatch 600 eggs, you will have to use two incubators of three hundred eggs capacity each. As it is no more trouble to look after a 300-eggs incubator than a 100-eggs one and the amount of oil burned by the larger size is very little more than the smaller and also as one 300-eggs incubator does not cost nearly as much as three 100-eggs models, there is no object in using incubators with a capacity of less than 300 eggs. If you specify self-turning trays the turning pro-

cess only takes a few seconds however many eggs there are in a tray. In America day-old chicks are hatched in special incubator houses by the hundred thousands. By using two incubators of moderate size and filling them on succeeding days the hatching of the chicks can also be spread over two days instead of one. However five hundred chicks are not too many to handle conveniently in a couple of days.

If you are going to deliver locally it is most important to have your delivery round carefully worked out so that there is no running backward and forward and covering the same ground more than once and no avoidable delay in delivery. No effort should be spared to have all your chicks booked long before they are hatched, because, curious as it may seem, day-old chicks, up to even three days old, travel much better than older birds.

When the incubators have been cleared of shell, brushed out, and scrubbed with strong disinfectant, the lamp filled and the humidifier replenished with water, they should be refilled immediately with eggs which have been kept ready, and started on another three weeks' run while the others are being attended to. As the incubators have to be refilled after sterilization and the chicks got off on the same days, Saturday and Sunday will be the busiest days in the week. After this, things will calm down for three or four days. In order to avoid confusion, tasks must be allotted long before the chicks appear, and the various people rehearsed in their particular jobs. One man, or woman, to remove the chicks from the incubator and put them in a safe place to await delivery, and then to clean, disinfect, and refill the machine. A couple more to pack and deliver the chicks and so fourth, for if anything is left to the last moment the only result will be confusion, mistakes and loss.

Although I do not recommend the delivery of live chicks by train in India, it may have to be done on occasion, and then only short trips should be attempted. There is greater likelihood of live chicks arriving in good condition if they are despatched by coasting steamer, when this is possible. Two dozen chicks can be despatched in a light wooden box, 15 inches square and nine inches deep. A large number of holes, one-half inch in diameter, should be bored near the

top of the box for ventilation, and this is particularly important in India. Corrugated cardboard or some similar material such as felt, should be nailed in the corners to round them off, and the part between the cardboard and the box packed with soft grass or cotton wool to prevent a chick from getting jammed into a corner on account of rough handling. About one inch of paddy husks or finely chopped soft dry grass should be spread on the bottom and the top of the box *screwed down*. If it is merely nailed, some clumsy person is sure to kill a few chickens in getting the lid of the box off. A box nine inches wide, fourteen inches long and nine inches deep, will take one dozen chicks. Of course, the corners must be rounded and paddy husks spread on the bottom just as in the larger box. No food or water will be necessary and no food must be given to the chicks before they start on their journey. Remember that if chicks are given a meal before they have picked up a good deal of grit they will die.

INSTRUCTIONS FOR THE PURCHASER: The chick boxes should be clearly marked in large letters: **LIVE CHICKS. THIS SIDE UP**, and the address of the buyer equally clearly written. It is advisable to warn the consignee, by telegram at his expense, by what train to expect his chicks. As your customer may be a complete novice in poultry keeping it is just as well to paste onto the lid of the box some instructions as to how to treat the chicks on arrival. Here are suggested instructions.

- (1) Open the box carefully or you will damage your chicks. They are very delicate and easily killed.
- (2) On taking the chicks out, if the weather is cold, put them in a basket with fine hay, near the fire, and give them grit to pick up, in a shallow tin. Fairly fine sand will do.
- (3) On no account feed your chicks until they have had plenty of grit, or they will die.
- (4) Their first meal should be chopped hard boiled egg, or bread and milk given dry, not sloppy, or oatmeal and milk, the same. For the first day or two the diet may be alternate feeds of mash as above and fine

grain, broken rice, bagery, or any small seeds such as canary seed, given every two hours. The chicks should have a good feed of small grain just before they go to sleep. Give, at all times, plenty of fresh water in clean uncontaminated containers.

- (5) After dark, place them under a broody hen, a few at a time, as the hen may refuse to accept them. If the hen settles down happily with the strange chicks, let her have the rest. If she does not keep the chicks, after feeding them, keep in a covered box near the fire where rats cannot get at them, and try another hen next day. Do not try to give the chicks to a broody hen during the daytime, she will only kill them. As she recognizes them by scent, and until they have acquired the scent of her body by being under her wings all night she will consider them as belonging to some other hen and will be hostile to them.
- (6) If no other box is available the chicks can be kept at night in the box in which they arrive, provided it is kept warm but not hot. The chicks must be allowed out in the daytime and given plenty of green food. Lettuce, lucern, chopped onion tops, or fine fresh grass, and plenty of fresh air.

It will pay you to make certain that the people who buy your chicks don't kill them during the first twenty-four hours through sheer ignorance and neglect. If anything goes wrong through their own carelessness they are quite certain to blame you.

In dealing with day-old chicks it must be remembered that they have been produced under just as artificial and unnatural conditions as it is possible to imagine and they start life with a corresponding handicap. Once they are out of the shell and in the hands of their permanent owners everything should be done to make their lives approximate as closely as possible to natural conditions of wild life, by giving them as much liberty, fresh air, exercise, green food, and a varied and nutritious diet, as possible. Any serious setback is likely to affect their normal development and usefulness later in life.

To run the day-old chick business on the scale suggested, it would be necessary to start two 300-eggs incubators each week for three weeks. As the period of incubation of hen's eggs is exactly three weeks, by the time the last incubator is filled and started, the first batch of chickens will be hatched and ready for sale. After this a couple of incubators full of chicks would be ready each week. In order to run this system, six 300-eggs incubators would be necessary, with one spare in case of accident or damage, making seven incubators in all, with several spare thermometers in case of breakage.

However, it is not necessary, or advised, that a start should be made with a considerable plant of this kind until the situation has been tested on a much smaller scale. It would be best to start with one, two, or three incubators, although smaller than 300-eggs machines are not advised for this business, and see how the market develops. If there is a steady demand, additional incubators could be ordered. It is advisable to stick to one make once its working has been thoroughly mastered. A large number of small incubators merely adds to the expenses of the plant and makes a good deal of additional work.

CHAPTER IX

CHICK REARING

THERE are two ways of rearing young chickens: the, more or less, natural way of using a broody hen and the entirely artificial way of using incubators and brooders. On a small scale the first is undoubtedly the better and more natural way and likely to produce more satisfactory results. Unfortunately it cannot be adopted where really large numbers of chicks are being dealt with. The number of broody hens, the space required, and the number of individual coops necessary are prohibitive. Also the attention required to look after anything from thirty to fifty separate coops and the time consumed in setting out both food and water entails an amount of labour incompatible with profits. Whereas, looking after and feeding say six hundred small chicks housed in brooders is nothing like such a formidable task, although even then about a dozen brooders would be required and considerable space necessary.

In order to realize the conditions under which chicks should be reared for optimum results in health and vigour picture to yourself the natural conditions under which jungle fowls live in the wild state. They generally inhabit open patches of jungle interspersed with spaces of grass in the drier parts of India and very often rock-strewn hillsides. They have unlimited liberty to roam and search for food over large areas of land on which the food they live on is none too plentiful and the ground is mostly gravelly or rocky and well drained, not to say decidedly parched. Their diet consists of the seeds of grasses, insects of all kinds, and, regrettable as it is to mention, the crops of the none-too-prosperous Indian cultivator. They have to travel long distances and work hard to get the food they need, but, as every sportsman knows, they are almost invariably in splendid condition, well fed but not fat, and as tough as nails on account of

the enormous amount of exercise they take. On the other hand they only lay about a dozen eggs a year most of which they successfully hatch into hardy and healthy chicks which also have to work hard for their living. But the points I wish to emphasize are that fowls are indigenous to India and therefore are being kept, under artificial conditions it is true, in the climate which is natural to them. In their wild state, of course, they live an entirely outdoor life, chicks as well as adult birds, perching on trees in the jungle if full grown or sleeping under bushes or fallen tree trunks while still chicks. They get no pampering of any kind, young or old, and are perfectly capable of looking after themselves. However, they have ample range over ground ideally suited to them and therefore never contaminate the land on which they live, a very important point. They are therefore almost entirely free from disease.

Domesticated fowls, to a large extent, retain their natural wild instincts and if given a chance and kept off contaminated ground will find a large part of the food they need and look after themselves very well. In rearing young chicks the natural conditions under which they live in a wild state should be imitated as far as possible and they should, at all times, be given as much free range as possible over land which will provide them with a considerable part of their natural food. This consists more especially of green food, grass and succulent leaves of all kinds, and insects, worms, grubs, ants' eggs, etc. Endeavours to visualize as far as possible these natural conditions and copy them as far as circumstances permit.

NATURAL REARING: After the chicks are hatched, leave them alone for the first twenty-four hours, feeding the hen as usual. The empty shells should be removed but nothing else done for the chicks. After the first twenty-four hours the hen and her chicks should be removed to a coop, situated if possible on a space of short dry grass. The hen should then be given a good feed of mash and plenty of green food, but see that the chicks do not eat any until they have had an ample supply of grit or they will mysteriously die. A saucer full of coarse hard sand should be placed where the chicks can get it and another saucer or shallow

dish full of clean water. As the chicks will get into the water if they can and contaminate it, a small cup should be inverted in the dish of water in such a way that only a narrow rim of water is accessible to the chicks. An inverted tumbler does very well. The hen and her chicks will have been shifted to their coop on the morning after the chicks are hatched and grit and water will have been placed before them while the mother is being fed with a substantial feed of mash and green food. If no other green food is available, onion tops chopped up fine may be included in the mash for the hen. About mid-day the chicks ought to have picked up enough grit and they should then be given their first meal. This can be one of the following: chopped hard boiled egg; oatmeal moistened with a little milk; bread and milk; or any meal such as barley meal or rice bran which may be available, but the first mentioned is best.

It should be remembered that newly hatched chicks must be regularly fed every two or three hours until they are three weeks old. After the first meal they may be given a hard grain meal consisting of broken rice, or any grain such as wheat or barley broken small. Small whole seeds such as canary seed or bargey are just as good, but a ready mixed chick feed such as Spratt's "Chicko" is the best for the first fortnight at last. This has all the ingredients necessary for the growing chick without the need for supplying them separately. If "Chicko" is not given then some form of calcium must be provided, such as shells broken fine or green bone. Of these green bone is the best. It can be made by scraping any bone with a heavy knife or by grinding up splinters of bone on a curry stone. It contains all the nourishment needed for bone formation in the growing chicks and is very good for laying hens too. For the first fortnight the young chicks should be given three meals of mash, as above, one in early morning, one at mid-day, and one at night. For the other meals small whole grain should be buried in the litter of the enclosure for the chicks to find by scratching. This will save the trouble of supplying numerous meals during the course of the day. Green food must also be supplied unless the coop is placed on young short grass when the chicks will find it for themselves. In order to make certain

that they get at least a certain amount of green food, chopped onions or onion tops should be included in the mash. The mother hen can have a meal of mash, the same as for her chicks, in the morning and a small feed of whole hard grain at mid-day and another at night. This may be wheat, paddy, jowar, or any grain available.

MANAGEMENT OF COOPS: Where the ground is dry, which it will be in most parts of India, hen coops may be made without floors, but in some very wet places and where the soil consists of clay, which holds moisture, they should be fitted with a movable floor which can be easily cleaned. Where possible the coop should be placed in an area of short grass and moved every day to a fresh spot. This need only be a few feet away. This object of this is to keep the ground uncontaminated with droppings. For the same reason, if the coop is fitted with a floor, this should be taken out and scrubbed or scraped every other day. This may seem very troublesome but if you wish your chicks to be robust and healthy it is absolutely necessary. Remember what I said about fowls in their wild state; they never stay on the same ground for even one single day, that is why they are so healthy. The coop should be fitted with bars in front, which will keep the mother hen in but let the chicks out; they will not stray far and will thus get plenty of exercise exploring the neighbourhood. It is a good idea to have a big shallow tray, about three feet square, the bottom of which is covered with a layer of paddy, wheat or barley husks, about one inch deep, in which the small whole grain is buried so that the chicks have to scratch in order to find it. This may be placed about a foot from the front of the coop, where the hen can see it. This will keep your chicks busy all day and prevent them from straying. They will thus be strong and healthy. Don't forget to have a vessel of water near enough for the hen to be able to reach it all day. Grit and water for chicks must also be near the coop. Green food must be given every day without fail.

When the chicks are about two weeks old, if there is a closed garden or yard free from crows, rats, stray cats, or dogs, the hen and her chicks should be allowed to range in it and scratch about all day. The meals should always be

given near the coop and the chicks must be shut up in the coop at night to prevent rats from killing them. This they will do even when the hen is there to protect them, so the coop must be rat proof. I shall give instructions for the eradication of rats in a subsequent chapter. If there are many crows about the chicks must be confined in a closed run.

As soon as the chicks are six weeks old they should be reduced to two meals of mash a day, one in the morning and one in the evening, and the rest of the day they should be fed on hard grain which should gradually be increased in size. At this age they are big enough to occupy a special house in which they can roost, but should not be mixed with larger hens. As chicks of this age cannot jump more than about three or four inches off the ground, a little ladder with close spaced rungs should lead to the perch or perches. As soon as the cockerels can be distinguished from the pullets, by the growth of their combs, all cockerels destined for fattening should be separated from the others and specially fed, as is explained in a following section.

REARING OF INCUBATOR CHICKS: If chicks hatched and reared by broody hens are brought up under artificial and unnatural conditions, how much more so are chicks which are incubated and then reared in brooders? In considering the rearing of incubator hatched chicks it must be remembered that the conditions under which they are being brought up are so foreign to their nature and instincts that one single serious mistake may kill off a whole incubator full of seemingly healthy young birds. Here are some of the causes of serious loss or lack of success in bringing incubator chicks to healthy maturity. They must all be carefully guarded against.

- (1) Endeavouring to hatch from unsuitable eggs. That is, the eggs of hens kept under intensive or confined conditions; the eggs of hens which have exhausted themselves by overlaying; or eggs of immature hens mated to immature cocks, etc.
- (2) Weakly chicks from eggs which have been carelessly or improperly incubated due to such mistakes as letting the eggs get chilled by allowing the incubator

lamp to go out and remain out for a considerable period. Neglect to turn the eggs regularly. Fumes from the lamp getting into the eggs chamber. Humidifier out of order or not regularly replenished with water.

- (3) Chicks chilled on way from incubator to brooder or put into a chilly brooder in cold weather. Chicks chilled through not being educated to use warm chamber of brooder.
- (4) Chicks given food before they have had sufficient grit.
- (5) Chicks kept on cold, damp, or waterlogged ground.
- (6) Chicks allowed to get wet and remain wet.
- (7) Dirty or vermin infested brooders.
- (8) Ground contaminated with disease by adult hens.
- (9) Improper, insufficient, or contaminated food.
- (10) Wet sloppy mash, which gives chicks diarrhoea.
- (11) Insufficient green food, grit, lime, or animal food, such as, meat, green bone, or minerals, such as lime.
- (12) Dirty contaminated water or water troughs allowed to get dry and remain dry so the chicks get insufficient drinking water.

This may seem a formidable list but at one time or another every poultry keeper has been guilty of committing one or other of these elementary mistakes and he may, or may not, be surprised and hurt because his chicks fail to thrive or even die off by dozen. On the top of all these possibilities of error must be added lack of exercise. Although lack of exercise is unlikely to kill off all your chicks it will certainly retard their development and prevent them from ever being healthy and prolific layers. If you are mysteriously losing chicks and cannot think why, just go over this list and endeavour to trace where you have gone wrong and put it right immediately. It is a good plan to go over the list point by point, preferably with the brooder in front of you, and see where you have gone wrong.

When chicks are hatched they should be left in the drying drawer for twenty-four hours while the brooder is being got ready for them. If in a cold part of this country, such as the Punjab in the winter, or the hills, a brooder with heating arrangements will be required and the lamp should be.

lit and the brooder warmed up as soon as there is any sign of the chicks breaking their shells. For the first week the temperature of the inner compartment of the brooder, by thermometer not by guesswork, should be kept at a steady 100°F. When the chicks are properly dry they should be transferred to the brooder in a basket lined with paper, to avoid drafts and chilling, and placed in the warm compartment, the floor of which has been spread with about one inch of litter, preferably husks but finely chopped dry grass will do. If the weather is chilly the chicks should not be allowed out of the brooder until the sun is well up and the ground warmed. In the meanwhile a shallow tray, sardine tin, containing coarse grit should be placed in the brooder for the chicks to peck at. By the time the sun has warmed the ground the chicks will have picked up sufficient grit and they may then be given their first meal as for chicks reared under a hen. The directions for feeding apply equally to chicks reared by a hen or in brooders.

In the southern parts of India, where there is little difference in the temperature during summer and winter, the brooder need not have a lamp and the chicks can be transferred to it as soon as the sun has warmed it up. In cold weather, with a lamp-heated brooder the chicks will not understand the meaning of the warm compartment at first and must be watched carefully until they have learned to use it without help. Lots of chickens are lost because of the ignorance of poultry keepers about this important point. If the chicks show signs of discomfort by huddling together in groups it means that they are feeling cold and must be put into the warm compartment by hand every time this occurs until they run automatically into the warm compartment as soon as they feel cold. In warm climates, the lid of the brooder should be kept open during the day or it will get too hot, but at night it must be closed and the chicks carefully shut in or rats will get in and kill them. The same applies if there are crows about. In this case the lid must be kept closed or only partly open and the chicks supplied with a closed and covered run from which they cannot escape or they will be immediately snapped up by crows. Brooders, should be moved to fresh ground every day like coops.

This brings us to the subject of brooders. They are of many types, both warmed and fireless. In fact, there are so many types that it is impossible to describe them all. The design of successful brooders has been arrived at after years of research and practical experience and modern appliances have been so improved that they may be relied upon to do what is expected of them provided they are bought from reputable and experienced makers. So many factors have to be taken into consideration in building brooders that it is not advisable for an amateur to undertake their construction. They must be free from lamp fumes; well ventilated but free from drafts; waterproof; easily taken apart for cleaning purposes; efficiently warmed from above in the inner chamber and so forth. The list of requirements is a formidable one. It is far better to buy a well designed and substantially constructed brooder from a reliable firm than to make do with a homemade or inferior article, with which failure is almost inevitable. However, there is a possibility of buying one professionally designed brooder and having it copied locally. This applies to the warmer parts of India where artificial warming is not necessary. Where lamp warming is essential it is wisest to buy all the brooders required ready made. Most makers of incubators also make brooders and it is best to select a suitable type from their catalogues. There is one important point to remember in ordering brooders for use in India. A brooder which may be adequate for 100 chicks in England will not take more than half that number in India on account of the greater quantity of fresh air required. Chicks do so much better if they are not crowded that it is very wasteful to put more than about 50 chicks together.

PLACING OF BROODERS: A considerable area of short grass is almost essential if chicks are to be brought up successfully by anything so artificial as mechanical mothers. If plenty of grass is available the brooders should be placed on it, preferably under the shade of a tree. If no tree is handy some other form of shade, for example, a gunny bag thrown over a part of the run, must be provided. As most brooders have the floors of the warming and sleeping chambers well off the ground, the brooder itself need not be moved every day, but the run should be shifted to allow the chicks to

run on fresh ground. This can be done by turning the brooder every day so that it faces a fresh patch of grass on which the run will be placed. Young chicks have so many enemies in India, crows, hawks, and rats, that it is advisable always to have an entirely covered run. If you are so fortunate as to live in a place free from crows and hawks you may attach a simple run made of wire netting, about twelve inches high, to the brooder, supported by iron spikes about eighteen inches long stuck into the ground. A run of this kind may be enlarged at will and shifted round the brooder without actually moving it or even turning it round. As the chicks grow the run should be extended in area.

After the chicks have been in the original brooder for three weeks and have by that time grown very considerably they should be shifted to a similar kind of brooder but of a simpler pattern and at least twice the size, made locally, in order to give the growing chicks ample air space. Overcrowding is one of the most fertile sources of disease and death. All brooders should be thoroughly searched every morning and evening for dead chicks, the corpses removed without delay and immediately destroyed, preferably by burning. If this is not done, in the torrid climate of India one dead chick will contaminate the whole brooder and may cause the death of all the chicks in it on account of the contaminated air and the bad gases given off.

If large number of chicks are being hatched in weekly batches a very large number of brooders will be necessary, but if only one incubator is being used a batch of chicks will be due every three weeks. As three weeks is about the time that chicks have to be kept in a brooder, this can be cleared of chicks, which would be shifted to a larger machine, and after being thoroughly scraped and scrubbed with disinfectant, the lately vacated brooder is refilled with a fresh batch of chicks from the incubator. But a brooder should never be used for a fresh batch until it has been thoroughly disinfected. Nothing is more fatal than a dirty brooder. If you are using one 150-eggs incubator you will need three small brooders, each designed for 100 chicks in the climate of England, and also three brooders (locally made) of about double the size, and two large chick houses—one for cockerels

and one for pullets. The procedure will then be as follows. The 150 chicks from the incubator, if you are so lucky as to get a 100% hatch (which I have done), will be transferred in batches of 50 to the three brooders, and the incubator refilled after disinfection. After being in the smaller sized brooders for three weeks the 50 chicks, or what are left of them, are shifted to the larger brooders and the first are left empty to receive the latest batch of chicks from the incubator. On the arrival of a third lot of chicks they are placed in the first lot of brooders for three weeks and after the larger brooders are emptied and the now large chicks have been transferred to the chicken house, all the chicks are moved up one stage. Thus all your brooders are being made the fullest use of.

Brooders are usually divided into two compartments, one inner sleeping or warm compartment and an outer intermediate one. This intermediate chamber should have its floor covered with an inch of paddy husks or litter and this space used in which to bury the chicks' daily ration of hard grain. They will thus be kept busy scratching for it under cover and get all the exercise they need. Additional exercise in the fresh air can be given by hanging fresh green leaves, lettuce or cabbage, in the run, just out of reach of the chicks so that they have to jump to reach it. This kind of continual exercise is particularly necessary for chicks which are kept in such confined quarters.

If you are breeding sex-linked chicks, the sexes should be separated as soon as hatched and the cockerels and pullets kept from the first in separate brooders. If this is done, and the cockerels are going to be fattened for the table, they should be fed almost entirely on soft food with only a very small allowance of hard grain. However, just as much green food is necessary for cockerels as for pullets and also a certain amount of animal food such as meat scraps, boiled fish, or green bone. When they are six weeks old they should be transferred to a large chicken house, but kept on soft food until they are large enough for killing. If obtainable, ground oats moistened with milk and some meat and green stuff like chopped onion tops, is the best fattening feed. Where this is not obtainable barley meal, wheat sharps (soogy), rice

bran or maize meal may be substituted. Generally speaking fowls will be fed on whatever is most easily and cheaply obtainable in the district. The idea should be kept in mind that for fattening purposes a wet mash is best and for egg-production wet mash and hard grain, the latter predominating. Cockerels which are destined for fattening need only sufficient exercise to keep them in good health, but pullets which are destined for egg-production must be kept in hard condition, muscular and energetic, and never allowed to get fat or they will not lay. This is why it is advisable to separate the sexes as soon as possible and feed them differently. If cockerels are fed on grain their crops remain small and cannot hold enough soft food to fatten them quickly, so they must be fed on a bulky soft mash from the beginning.

The programme for keeping chicks on a large scale with the utmost economy of apparatus could be as follows. Chicks from incubator to three weeks old in batches of 50, housed in brooders designed to hold 100 chicks in England. Chicks from three weeks to six weeks in double sized brooders, chicks over six weeks old in a large chicken house. As fresh batches of chicks come from the incubator, each batch of chicks is moved up one stage, finally coming to a standstill in the large chicken house where they will remain until they are large enough to shift entirely for themselves. Cockerels and pullets to be kept separate as far as possible and fed differently.

Chicks do best on a rather dry gravelly, but not sandy, soil which is usually barren, on which they can find enough insect food to satisfy their needs. This implies a large garden, orchard, or expanse of grass interspersed with trees and bushes on which they will find for themselves all the green food and insects they need, and in hunting about for them as much healthy exercise as is good for them. In the management of brooders this should be remembered and the chicks given as much liberty as may be compatible with their safety. Where there is a large area of grass the chicks may be given their liberty for at least a part of the day after they are three weeks old, but they must be protected from crows and hawks. If there are no means of providing them with a supply of natural insect food their diet must contain twenty

five per cent of animal food, blood meal, meat scraps, green bone, or fish meal. If this is not available, boiled fish will do and the water in which the fish has been boiled may be used to mix the mash. In making up a mash composed of meal and milk, sour milk or *dhai* is better than fresh milk. Ten per cent of the diet of young chicks and grown fowls alike should consist of green food: for chicks chopped onions, onion tops, or any soft green leaves, and for grown fowls lawn clippings or any other form of chopped grass, cabbage leaves, etc.

It is practically impossible to overfeed young chicks up to their sixth week and this is the important period in their lives. Any setback during the first three months will affect them for life and it is very difficult to counteract any such check which they may receive. It is better therefore to make certain that they are properly fed and looked after than try to remedy the effects of neglect later on when you may be losing eggs.

RECAPITULATION: Don't crowd your chicks. Give them as much liberty as you dare. Keep all brooders and feeding and watering vessels scrupulously clean, as clean as you would if you were using them yourself. Continually move them to fresh ground and do not let them run on land which has already been contaminated by adult fowls. Feed them properly and adequately. Give them plenty of fresh clean water, coarse grit, broken shells, and green food. Here is a programme of feeding set out as shortly as possible in order to fix it in the memory.

- (1) *From hatching to three weeks.* Both cockerels and pullets alike. Mash in the early morning, at mid-day and the last thing at night. Small whole grain in between. Broken rice, canary seed, ragi or any mixed small seeds. Plenty of green food, chopped onion, onion tops or any soft leafy vegetable in the mash and larger leaves hung in the run. Coarse grit, broken shell, and water always available.
- (2) *From three weeks to six weeks.* Cockerels separated from pullets and fed the same three mash meals with a very little grain in between, buried in litter to give

them exercise. Pullets must be kept muscular and active. Mash in morning and evening, small whole grain of larger kind and well mixed. Broken wheat, ragi, broken rice, jowar etc. Pullets must get plenty of exercise all day. Same precautions about grit, shell, and water as well as green food.

If no insect food is available the diet should contain one quarter of its weight of animal food, meat, green bone, fish. At least ten per cent of green food, from the earliest age.

- (3) *After the age of six weeks.* Cockerels still on mash but reduced to twice a day with a small meal of whole grain at mid-day. All chicks may now be fed whole grain of the larger kinds with the husks on. Wheat, barley, paddy, ragi, millet or whatever is available locally. Pullets to be fed only one feed of mash in the evening mixed with sour milk. This can be ground oats, barley meal, rice bran, wheat residues or whatever is available locally. One quarter of the mash should be animal food of some kind and plenty of green food, green bone, grit and lime. Grain feed morning and mid-day, with exercise.

CHAPTER X

THE MANAGEMENT OF LAYING HENS

IT does not much matter whether you keep one dozen hens or one thousand, the management required for high egg yield is the same; the only difference is that if you mismanage you will lose more on a thousand hens than you will on a dozen, because the larger flock will consume several tons of food during the year and the dozen hens can mostly be fed on house scraps and their feed will cost practically nothing. So if you have kept a few hens successfully and profitably don't imagine you are going to extend the scale of operations to a thousand birds and get the same gratifying profits.

What fowls are fed on in England and America is not necessarily what they can be profitably fed on in India. The price of foodstuffs is a very important item. It may be, and very often is, profitable to feed small chicks on ground oats, because they eat very little of it and it contributes so much to their strength and robustness that a little extra expense may be well worth while. The fall in the mortality rate may amply compensate for the extra cost of the food for a few weeks. However, when we come to feeding large flocks of mature fowls the case is very different. Roughly speaking the cost of feed is the factor which, to a very large extent, controls profit. The poultry keeper in India must use his intelligence and initiative to the fullest extent in adapting the cheaper grain to be obtained in his particular province to the need of his flock.

India is a large country and the climate differs very widely in different parts. What may be very easily procurable in one district may be unheard of in another so it is impossible to lay down hard and fast rules for the feeding of poultry in India and it is not necessary either. Generally speaking there is not very much to choose in the feeding value of different grain mixtures. A carefully considered mixture of Indian grain is just as nutritious as another of grains available in

England or America, and probably suits the needs of a tropical climate better. Heating foods, such as wheat and maize are not so necessary in India as they are in the far colder climates of European countries as anyone who has worked in an office in Calcutta or Jacobabad during the hot weather without a punkha will realize. However, in the colder parts of India, such as the Punjab and the hill districts, where wheat is available, it has its uses, and that is why it is mentioned although it may not be available in the southern provinces. Dal and other peas and beans must be avoided as they all give hens a liver complaint which ultimately stops them from laying.

Heavy layers must be muscular, active, and energetic foragers, for if they are allowed to get fat they will not lay. Every effort must be made to give them as much exercise as possible and the best way to do this is to allow them to forage for themselves over a large area which will not get heavily contaminated with their droppings and so spread disease. Provided hens are allowed sufficient free range in places where there are plenty of grass seeds and insects they are perfectly capable of finding sufficient food to satisfy them and keep them perfectly healthy, just as wild fowl do. Unfortunately, wild fowl, although perfectly healthy and muscular, only lay a couple of dozen eggs a year at most and hens fed on the same principles, though just as healthy as wild birds, will only lay about the same number of eggs, which would not suit the enthusiastic Indian poultry keeper out for profits.

The highly bred domesticated fowl has been developed for intensive eggs-laying and to fatten easily for the table, both highly artificial characteristics and totally different from those of its wild ancestors. In order to get more eggs a far greater quantity of food is required and moreover this extra food must be properly digested and of the kind which is easily turned into eggs. Now, eggs consist largely of water and what is not water is mostly protein, or animal food—the white (or albumen) of an egg is almost entirely protein. Flesh, muscle, bones, blood, brain, nerves, and feathers are also mostly formed from protein foods. It is therefore one of the most important elements in the diet for the formation of eggs

and bodily organs. However, protein intake can be overdone and such foods as peas, beans, dal, and linseed which all contain over 25% of proteins in a very concentrated form should be avoided. Here is a list of different grains, mostly available in India, with their protein, fat and starch contents. Some English grains have been included for comparison, for instance, oats. It will be seen that the protein and starch content of oats and millet (jowar) is almost identical, so where ground oats is recommended, ground millet may be substituted. The list is given in order that the Indian poultry keeper may make up feeds from local grains which are almost as nutritious as those recommended in European or American poultry books, although of course digestibility and mineral content are bound to vary to a certain extent.

	Protein %	Starch %	Fat
Barley	8.6	68	1.5
Dari (Ragi)	9.6	71	3.8
Millet (jowar)	10.6	61	3.9
Oats	10.3	58	4.8
Rice (polished)	6.7	78	0.4
Sunflower seed	14.2	14.5	32.0
Wheat grain	12.0	69	1.9
„ offals	14.2	55.6	4.8
„ straw	3.7	42.6	1.2
Maize grain	9.9	69.0	4.4
„ meal	9.2	68.7	3.8
„ bran	8.4	62.0	4.2
Lucerne hay	14.2	29.2	2.6
Meadow hay	9.7	41.0	2.5
Blood meal	81.0	1.5	0.8
Meat meal	72.2		13.2
Fish meal	55.0	2.1	4.4

From these figures it will be seen that millet and oats have very nearly the same percentages of protein and starch, but that millet has slightly more fat or oil. Where oatmeal is mentioned, coarsely ground millet may be substituted. You will see that blood, meat, and fish meals consist almost entirely of proteins and fat. Of course, these are dried pro-

ducts and contain a very much larger percentage of proteins than either fresh meat or fresh fish. If they are procurable only about ten per cent should be added to the feed. In the case of fresh meat, fish, or green bone this may be increased to one quarter of the mash because they contain much more water. You will observe that all grains contain the three ingredients—protein, starch, and fat, but in different proportions. Protein is needed for body and muscle building and is mostly used up for these purposes, as well as for egg-production. It is not stored up in the body as fat is and therefore an adequate daily ration of it, in assimilable form, is required, specially for heavy egg layers. You may say roughly, no animal protein, no eggs. The point about blood, bone, meat, and fish meals is that they are animal proteins and take the place of grubs, worms, slugs, and other insects such as grasshoppers and caterpillars, which are not found in the earth. The protein contained in dal, peas, and beans is not an animal protein and does not take the place of insects.

Starchy foods are fat and heat producing and fat is stored up in the body. Therefore such grains as wheat and maize, which contain a great deal of starch are good for fattening, but if given to laying hens in anything but a very small quantity will cause them to get fat and stop laying. They need the energy producing protein foods, which only contain a reasonable proportion of starch and a little fat. Rice which contains 78% of starch, the highest of any food grain, might seem to be far too fattening for laying hens. However, this figure refers to polished rice which should never be given to fowls. Paddy is the form of rice recommended because it contains not only the husk, which is good for fowls and contains a good deal of essential mineral matter, but also the cuticle of the rice, which is removed in the process of polishing, and contains valuable vitamins, which polished rice does not. It is a valuable food but should be given mixed with other grain containing a higher protein content, such as millet, and an animal protein should always be given in the mash. Sunflower seeds are very much appreciated by all poultry and they can be grown in the garden and fed as an occasional treat. The hens will get plenty of exercise in pecking the seeds out of the heads. Fats are heat forming

foods and are required more in cold climates than in India. The foods recommended contain ample fat for most parts of the country without any additions. Fat is far too expensive for practical poultry farming and is only used occasionally for fattening purposes, anyhow.

There is another class of foods which although they take no major part in the nourishment of the birds are none the less essential for health and strength. These are the minerals and certain protective foods which are required in small quantities to prevent deficiency diseases and lack of stamina. Minerals are mostly contained in the green food fowls consume; they are only present in minute quantities but are absolutely necessary all the same. Green food also performs another function and so does the husk of various grains—it provides roughage which is necessary for the regular functioning of the stomach and intestines. Where possible, all grains, rice, barley, wheat, and other grains should be fed without removal of the outside husk or bran. Carotin is the substance which gives the yellow colour to the yolk of eggs and is one of the protective food materials which is contained in yellow maize, carrots, tomatoes, and in fresh green grass. All the above are good for fowls if given occasionally, and are essential if they are deprived of access to young fresh grass. Your hens are sure to languish if they are deprived of the minerals contained in fresh vegetation and the calcium of crushed shells, however well you may feed them otherwise.

The shells of eggs require a very considerable quantity of calcium for their formation and the greater the number of eggs a hen lays the greater the quantity of calcium she must consume. If she does not get enough she will draw on the calcium in her own bones until she is so debilitated that she can lay no more and will also permanently damage her health and stamina. She would thus be useless for breeding purposes. Now the soil of India is notoriously deficient in calcium, so you must on no account fail to furnish your laying hens with an ample and constant supply of broken sea shells. Old mortar, in sufficient quantity, will do at a pinch, but a large supply is necessary and shells are much better. But anything is better than nothing.

Having now given a somewhat cursory review of the different classes of food stuffs and their functions, I will recapitulate before going on to explain how they are to be made up into adequate diets:

1. *Proteins*: For body building and egg production. Found abundantly in insects, bone meat, fish, and blood meals. Less abundantly in various grains and grasses, both fresh and dried.
2. *Starches*: For the production of heat and for fattening. The amount found in various grains is sufficient to provide all the heat needed in India. Found in all grains but particularly in rice, wheat, and maize, which are fattening grains.
3. *Fats*: For heat and fat production, also for protective compounds. Found in small quantities in all seeds but especially in oil seeds. Ordinary grains contain enough fat for Indian conditions.
4. *Minerals*: Calcium required in large quantities for the shells of eggs. Other minerals required as trace elements which although not contributing to nourishment are necessary for growth, also certain protective compounds and vitamins. Found in all green leaves and grasses. Particularly in fresh green grass, carrots, and tomatoes which contain carotin.

In order to get your money back from a flock of hens, whether this is a large one or a small one, those hens must lay a certain number of eggs. It is calculated that by the time a hen has laid seventy eggs she has paid for her keep and that the rest is profit. Now a whole flock of hens which all lay at least seventy eggs each is already far above the average of the jungle fowl, but to make certain of a reasonable and steady profit your hens must lay from 350 to four hundred eggs each before they are too old to be worth their continued keep. So they must be fed and managed in such a way that they will give the maximum egg-production of which they are capable. And this means that they have got to eat a great deal more than the average wild fowl and that it must be food of a different and more nourishing kind, providing a large proportion of those substances which are essential for egg production.

It has been proved that the muscular energetic hen which is always eagerly foraging about is the one which produces most eggs, and a fat and lethargic hen is no good for egg-production. The sooner she is mixed with some curry stuff and boiled the better, you will never be able to make better use or a profit out of her. I recommend that hens be given a feed of mixed grain in the early morning, well buried in litter out of which they will not be able to get it without a deal of scratching and searching. If you just scatter it on the ground they will pick it up in no time and get no exercise at all. Another feed of the same kind should be given in the middle of the day, and at night just before they go to roost a feed of nice crumbly mash, but by no means wet. This should consist of whatever meal is available in your district at a competitive price, mixed with about one quarter its weight of some kind of animal food. All day long green food, either growing naturally or provided in the shape of green leaves or lawn cuttings, should be available to them.

Undoubtedly the best way to keep laying hens is on a free range where a large area of grass land is available for them to roam on and pick up their green and insect food for themselves. In India elaborate hen houses are not necessary, as long as they are jackal, jungle cat, rat, mongoose, and thief proof, but practically unlimited free range is. And a free range which contains a large amount of insect and other food for a vast expanse of bare earth totally devoid of living matter of any kind is of no use; and a barren sandy soil is not much better. So when you are choosing the site of your future chicken farm, if you propose to operate on a large scale, be careful to select an area which is covered with grass, bushes, and trees for shade, and a large variety of other plants. You can provide most of the other essentials yourself.

Wild fowl, as I have said before, lead a completely outdoor life and come to no harm whatever, even in places like Burma which has a prolonged and severe monsoon, from which they can get no protection. I do not advocate keeping domesticated fowls under quite such severe conditions, but I do suggest that an Indian fowls' house needs no walls except of wire netting although a tight roof is essential. I

have tried this system myself with complete success, and out of the hundreds of fowls on the farm I never lost one due to exposure and never experienced any sickness due to that cause either. I recommend a house, or houses, composed entirely of wire netting, except in the Punjab and on the hills, stretched on a sturdy frame and no walls of any kind, except the low walls in the vicinity of nest boxes. I divided my land into two parts by a wire netting fence six feet high, and placed my laying houses so that they bisected this fence, half being on one side and half on the other. In this way I could let the hens out from either end of the laying house onto different areas of land. When they had been running on one plot for a month or two I changed them over to the other, the vacant plot being planted with various green crops for the hens to eat. I experimented with various crops and found groundnuts and a fast growing spinach best. But I also grew ragi, barley, and in the monsoon hill paddy which all did quite well and provided plenty of green food of the right type. In each plot there was a large scratching shed with a cement floor and corrugated iron roof, because the sheds were under the shade of trees. In the early morning, before the hens were let out, the grain feed was buried in the litter of the scratching shed. The litter was then all raked into a high pile in the middle of the shed and the birds let loose. They got eagerly to work and soon scratched the pile level, eating the grain as they did so. The process was repeated at mid-day. In the meanwhile the hens had a large area to roam over and help themselves to a variety of green food which had been grown with the aid of their own droppings. The idea of the separate scratching shed was that as the hens did not occupy it for long they did not contaminate the litter with droppings and it would therefore last longer. While it was raining the hens could congregate in the scratching shed out of the wet without disturbing the hens which were in the laying boxes or fouling the floor of the roosting house. This system worked so well that I recommend it to others. It is cheap and effective. As I kept my fowls on my rubber estate I had ample space available and plenty of trees for shade. However, I have seen plenty of places, in travelling round India where the same thing could be done, with different kinds of trees, of course.

Just as human beings like a variety in their diet so do fowls. As the object of the intelligent poultry farmer is to keep up the interest of his birds in their food so that they are, at all times, eager to get it, a change of diet at fairly frequent intervals is advisable, when it can be done without too much inconvenience and expense. As hard grain keeps hens in hard condition and, with the exceptions of wheat and maize, has not too much fat forming matter, it should comprise the major part of the diet of laying hens. This is also highly convenient because, of course, hard grain is not so troublesome to feed as mash and requires no preparation. But, in order to provide the necessary protein for the formation of eggs, which grains do not contain in sufficient quantity or quality, this must be supplemented with one feed of protein-rich mash per day. This is preferably given in the evening when it is most conveniently prepared. The hens will then have the whole night in which to digest their most important egg-forming food and turn it into eggs ready for laying in the morning, when nearly all eggs are laid.

Here are some mash mixtures suitable for the Indian climate, composed of substances which ought to be available all over the country. There is no need to adhere slavishly to the diets suggested in these tables. The general idea is to give, for every ten ounces of mash, two ounces of bran as roughage, two ounces of protein, three ounces of fresh or dried vegetable matter, whatever may be available, and three ounces of some kind of meal or ground grain. The quantities in the table are calculated for a flock of ten laying hens. If there are more hens, you simply have to multiply by the number of "tens" there are in the flock. Thus, if there are fifty birds, there are five units of ten birds each, and the quantities given must be multiplied by five. Seventy-five ounces of mixed grain in the morning, sixty at mid-day, and fifty ounces of mash in the evening, for fifty hens, and so on,

MORNING	MID-DAY	EVENING	COMPOSITION OF MASH
15 oz.	12 oz.	1 oz.	2 oz. Bran
Grain	Grain	Mash	2 oz. Lean meat
			3 oz. Chopped cabbage
			3 oz. Millet meal (jowar)
			<hr/> 10 oz. Total
15 oz.	12 oz.	1 oz.	2 oz. Bran
Grain	Grain	Mash	2 oz. Boiled fish, dried
			3 oz. Lucerne hay
			3 oz. Wheat offal (sugi)
			<hr/> 10 oz. Total
15 oz.	12 oz.	1 oz.	2 oz. Bran
Grain	Grain	Mash	2 oz. Green bone
			3 oz. Finely chopped hay
			3 oz. Rice bran (polishings)
			<hr/> 10 oz. Total

Bran means the outside husks of wheat or barley. Paddy husks should not be used as feed as they are too dry and harsh. The birds will get enough of this when they take their paddy ration. Rice bran means rice polishings which is a kind of meal separated in the process of polishing the rice and contains valuable protective vitamins.

Of all these ingredients the animal protein may be the most difficult to arrange for and I will make some suggestions which I hope will help to solve the problem cheaply and conveniently. It is possible to buy in England a simple hand operated machine for cutting fresh bones, called green bone, into thin shreds that are easily digested by fowls and form a very efficient form of animal protein, which affords some assimilable calcium as well. No large-scale Indian poultry farmer can afford to be without one of these machines which will solve his animal protein problem once and for all. I used one with great satisfaction and profit and would never be without one even on a small poultry farm. Bones are cheap and available all over India and every poultry

farmer can make arrangements with his local butcher who will be glad to find a purchaser for his surplus bones.

In the coastal districts cheap fish will be available; this can be the small fish which are of little or no commercial value. They can be boiled, squeezed dry of water, and added to the mash in double the quantity advised for meat and bone meal, because fresh fish still contains considerable water. The water the fish are boiled in may be used, boiling hot, to mix the mash with. All mash should be mixed with boiling water, but allowed to cool before it is fed to the fowls. Green bone is specially good for chicks.

In some places fresh blood may be available from the local slaughter house; if this is so it may also be used for mixing in mash, allowing twice the amount recommended for fresh meat. It contains a great deal of water.

Although a mixed hard grain ration is best on account of the blending of constituents, a single grain may be used. However, it is advisable to change this as often as possible. These grains may be chosen from unhusked paddy, or barley, millet, ragi, or any other cheap local grain. Wheat may be used in a mixture with about three times its weight of other grain but should not be used alone. Similarly, the meal in mash may compose, at a pinch, of whatever is available, coarsely ground and well mixed.

Remember the following vital necessities for laying hens:—

1. Plenty of fresh air in their laying house.
2. Freedom from the constant irritation of lice, by the use of numerous dust baths conveniently placed and kept dry.
3. Sanitary house, kept whitewashed every month. (See housing.)
4. Plenty of fresh clean water.
5. Ample shell lime.
6. Unlimited coarse grit.
7. Plenty of free range.
8. Unlimited exercise, both natural and artificial.
9. Food consisting chiefly of hard grain.
10. An animal protein—rich mash every evening.

11. Ample green food and an opportunity to catch fresh insects.
12. Shade under trees or bushes during the hot part of the day.

A good mixed grain ration for India consists of equal parts of unhusked paddy, barley, millet, and ragi. A little wheat or maize may be added in the hotter parts of India and in the cold parts wheat or maize should form about one-quarter of the mixture.

All laying hens should have plenty of dust baths available or they will get covered with lice which will slow down their laying. In the monsoon dust baths must be under cover, any kind of rough roof will do, as wet earth and ashes are no good for dust baths. The dust must be quite dry. I have used shallow boxes, about four feet square and eight inches deep, half filled with a mixture of finely powdered earth, well sifted, and sifted wood ashes 50-50. One of these boxes was placed in a corner of each scratching shed and others were scattered about near the buildings, one box to every twenty hens.

In the hot climate of India hens are thirsty birds and drink a great deal of water. If they do not get sufficient water they will not be able to lay because eggs consist very largely of water, and, remember, no water no eggs. I had plenty of water troughs scattered about under the trees, each emptied, cleaned, and filled every morning.

In order to keep up an adequate supply of fresh lime I collected fine sea shells from a neighbouring beach. These were fed to the hens just as they were and required no preparation by crushing. Larger shells will have to be pounded up quite small, specially for young chicks. These shells were then placed in empty milk cases scattered about under the trees and kept half filled. This shell material was greatly appreciated especially by the ducks, and the need was obvious from the crowd of hens which always surrounded these boxes, and the gratifying result was that I never got a thin shelled egg and none of my poultry ever suffered from debility due to lack of calcium; neither did my young chicks,

because they had green bone as well as shells, both very cheaply supplied.

If your land contains no obvious grit this must be supplied. The best grit is the hard and clean quartz sand of the right size from the bed of a stream or nullah. Quartz is the semi-transparent whitish or yellowish mineral in granite and as the granite is weathered and crumbles away this quartz, now in the form of sand, is carried into the neighbouring streams where it can be found. The coarser the grit the better. Your hens will pick out by instinct the correct size to suit them. Boxes of this grit should be left around just as I have described for boxes of broken shell.

Fresh water shells are just as good sources of lime as sea shells provided they are white and hard. If no other kind of lime is available, that which is used for chewing with betelnut may be used.

In adding fresh meat or fish to mash, it should be passed through a mincing machine to reduce it to a fine mince, which will mix evenly with the other ingredients of the mash. If this is done, fish can be passed through the mincer, bones, heads and all. But if not finely minced, bones should be separated first or your hens will choke themselves to death.

CHAPTER XI

FATTENING

AFTER about three weeks, during which they should be fed in the same manner as pullets required for egg laying, cockerels should be kept separately and fed differently. The kind of soft food on which they are fattened takes up a good deal more space in their coops than the hard grain ration on which laying pullets are fed. For this reason cockerels intended for fattening should be separated from pullets as soon as the sexes can be distinguished. In the case of sex-linked birds this will be as soon as they are out of the shell and in others when their combs begin to develop. From this time they should be kept in a pen by themselves and fed of mash in the morning and evening and a small ration of hard grain at mid-day. In England this mash is composed of ground oats mixed with milk. But in India as ground oats is not available, millet meal or, where it is available, barley meal will do. As sour milk, or dhai, is available all over India this should be used in mixing the mash in preference to fresh milk.

There is a very good reason for this. Dhai contains acids which make the meal more digestible and also supplies minerals and other components which would otherwise have to be furnished by some form of green food. If the mash is mixed with sour milk no vegetable matter is necessary. On the other hand, if fresh milk is used some green food, chopped onion tops, cabbage, or lettuce, must be included in the mash to keep the birds in good health. With laying pullets the main idea is to keep the birds lean, muscular, and active and to supply them with a muscle-and-egg forming diet. With cockerels for fattening the idea is to avoid any muscle forming food, to give them as little exercise as is compatible with good health, and to confine them exclusively to a diet which will form the greatest quantity of soft and delicate flesh in the shortest possible time, because fattening costs money.

As a rule cockerels will be ready for the table when they are about four months old and the fattening process will take about three weeks. So from the age of six weeks they should be fed on a diet of mash, and plenty of it, and when they are about thirteen weeks old they should be shifted to fattening pens.

Keeping hens for egg-production is a comparatively simple matter, but fattening is not. A great deal of skill and experience are required to get the best results. In England this is almost entirely done by experts who do nothing else and have reduced the matter to a fine art. Constant attention must be given to the health of birds and they must be kept under scrupulously clean conditions and given plenty of fresh air. Sick cockerels naturally do not put on fat. The diet consists almost entirely of fats and carbohydrates during the whole of the fattening period, the object being to develop a large quantity of white and tender flesh suffused with fat instead of water.

The fattening pens should be about seven feet long, two feet high, and two feet wide, with a broad shelf in front on which the feeding troughs could be placed. These pens will each hold ten birds. The sides and bottoms are composed of bars, or split bamboos, placed about one and one-half inches apart. The birds stand on these bars and the droppings will fall through and must be disposed of every day. The best way to do this is to place a sheet of corrugated iron below the pens onto which the droppings could fall and which can be removed quickly and easily. In cold weather these pens should be under a roof in some large shed protected from chills and drafts. In hot weather they should be out of doors but under the shade of trees. In this case the pens should be fitted with a watertight roof. The idea of this is to prevent the birds from getting any exercise and keeping them quiet and contented. They should not be placed where they will be disturbed by strangers or dogs. Remember that they have to put on the necessary final flesh and fat during the short space of three weeks. If they are slow in maturing it will be more profitable to put off the fattening process until the birds are full grown. This may not be until they are fully four months old in some

cases, depending on how they have been fed and treated previous to the fattening period.

Remember to keep your birds quiet and comfortable as any disturbance will interfere with the fattening process. After the cockerels have been placed in the pens they may, on account of the strangeness of their surroundings, refuse to take their food. No effort should be made to force them to eat. If they are left alone they will soon reconcile themselves to their new home and begin to take an interest in their food.

For fattening purposes the mash should be made sloppy, with plenty of milk or dhai, and one good feed should be given early in the morning, say at seven o'clock, and another at five in the evening. If the mash is made sloppy it will probably contain enough liquid for the birds without the addition of drinking water, but in the hot dry climate of India this may not be enough. So an experiment should be made by offering the birds a drink at mid-day. If they eagerly take advantage of this it is a sign that the milk in their mash is not supplying them with sufficient moisture, and water troughs, well filled with clean water, should be available to the cockerels all day.

After three weeks of this fattening process your cockerels will be ready for killing. In England the last week of fattening consists of cramming the birds with more food than they are willing to eat naturally. This undoubtedly adds to the flesh formed but it is a cruel and dangerous practice which I should advise the average poultry keeper to leave severely alone. If it is done by hand it is a very slow and tedious process and of doubtful utility. If it is done with a cramming machine, it is not only cruel but dangerous. An inexperienced or unskilful operator can very easily kill the birds instead of fattening them.

Remember that fattening birds have to digest the food given them just as other fowls have to and a good efficient digestion is even more important to them than to the others. Their gizzard is the only means they have of grinding up their food, even soft mash, and it is the stones in the gizzard, which do this work of grinding. No grit in the gizzard, no digestion of food, and no future for your cockerels except a

premature funeral. So give them plenty of coarse grit in a tin on the shelf in front of their bars. If the birds do not look too flourishing some green food will do them good and help to keep them interested in eating. It is, of course, of the utmost importance that they should have a good appetite all the time. Two ounces of mash at each meal should be the minimum. If they will eat more give it to them, but do not waste food by giving them more than they can manage.

CHAPTER XII

INTENSIVE POULTRY KEEPING

ANYONE who has kept half a dozen hens successfully in a backyard may think that he has only to extend the scale of his operations, to say twenty or twenty-five birds, in order to make the same profits on a larger scale. One may believe that intensive poultry keeping is, after all, only the backyard business on a glorified scale, using very much the same amount of space with a few unimportant modifications. However, it is precisely these insignificant alterations which make all the difference. In the full intensive system hens are kept all the time within doors and not allowed out at all. This system is so highly artificial and foreign to the natural habits of fowls that it requires a great amount of individual care and attention to detail, in order to make it a success. Most persons are not prepared to give a few hens so much of their time or to undertake the very large amount of daily routine labour involved. Compared to backyard poultry keeping the profits per bird are nothing like as large because twenty to thirty fowls cannot be fed on house scraps alone. None the less, for India, it has one very important advantage, and it is for that reason that I have included a description of it in this book. The owner can keep a very close watch on his birds, at all times, because they are never allowed to stray out of their house, and loss by theft is thereby reduced to a minimum.

Even when the poultry house is specially designed to save work in every conceivable manner, the amount of labour required to keep the house and its appliances in the necessary state of cleanliness and sanitation is very great. But regular periodic cleaning and disinfection must be undertaken in order to keep the birds in good health. Any carelessness or accumulation of filth are sure to lead to disease and loss.

As the roof of a poultry house is usually the most expensive part of the building, I recommend a two-storied house

for intensive poultry keeping in India. This should be constructed largely on the same principles as the smaller house advised for backyard poultry keepers. English poultrymen consider that ideal flock for the intensive system is between twenty and thirty, but for India with its much hotter climate and tendency to the very rapid breeding of vermin, I consider a flock of twenty birds the maximum which should be attempted, as in India, each bird will require at least five square feet of floor space; this will mean a house ten feet square, which is a handy size. The lower storey should be arranged very much in the same manner as that of the backyard poultry house and used as a scratching shed where the birds could spend the greater part of the day. If possible it should have a cement floor, but if this is out of the question, the earth should be raised above the level of the surroundings and well rammed down. Remember that someone will have to go into this space frequently in order to clean it out, so make it high enough to stand upright in without the necessity of stooping. All the sides, except the front, should be of one-inch galvanized wire netting and as this is obtainable in rolls six feet wide, a convenient height for this lower storey will be six feet. Height costs you practically nothing and will give your birds plenty of fresh air. The front should consist of bars placed one and one-half inches apart so that your hens can thrust their heads between the bars to get their food, which would be placed outside, well off the ground on a wide shelf running the whole length of the front of the house. There will be a wire netting-covered door in the side for access to the under part.

You will remember I told you that fowls in their wild state lead an entirely outdoor life and invariably roost in the open even in the wettest weather. They take no precautions against the rain except to roost in trees in order to keep out of the damp. The same precautions against damp should be taken in intensive poultry keeping by keeping the floor of the lower storey well above the level of the neighbouring ground and providing a tight roof which will not drip. Other than this the whole of the upper storey may be walled with wire netting exactly like the lower storey. There will be a line of outside nest boxes along one side, accessible from the outside

and removable for cleaning, and placed with their bottom boards about nine inches above the floor of the roosting or upper compartment. This is in order to prevent litter from getting into them. The roosting compartment should have a substantial floor as far as the perches, with a long slot and ladder for the hens to reach their perches and laying boxes. In a large house like this it will not be convenient to have a movable floor or tray so another arrangement should be adopted, but to keep the floor clean and make it easy to sweep away the droppings it should always be covered with litter. This can easily be swept through the slot left for the entrance of the fowls and removed from the lower part with the rest of the litter.

Removable perches should be fitted across the back of the house, placed at least eighteen inches apart and at different levels so as to give the birds as much fresh air as possible, and below these perches the floor or the roosting space should consist of one-inch wire netting instead of boards. The droppings will then fall through this netting onto a sloping droppings board which is placed in the lower compartment and is easily accessible for cleaning through the back of the lower compartment which is left open for the purpose. This droppings board can be made of a single sheet of asbestos-cement sheet eight feet long and four feet wide, placed at an angle of forty-five degrees, on wooden supports two feet apart. By this simple arrangement there will be particularly no droppings to remove from the upper compartment. However, as it will have to be periodically cleaned and whitewashed it should also be six feet high and have a door in one side, accessible by a short ladder. You will thus have a poultry house which has practically nothing to harbour lice and can be cleaned and maintained with the minimum of trouble, as well as giving your hens all the fresh air they can possibly need. In the hills and the colder parts of India it may be necessary to make the sides and back of the upper storey of wood or cement-asbestos sheets, but the front should always be open. The less your birds are mollycoddled the hardier they will be. Most people herd their hens in far too small and overcrowded little stuffy rabbit hutches and wonder why they are always ailing. Given a chance hens are hardy birds and

provided they are kept dry will survive great extremes of climate without coming to any harm, but they will not survive filth, vermin, stuffy overcrowded quarters, and wet feet. Neither can they do without plenty of fresh green food, grit, crushed shells, and clean fresh water. If you attend to all these matters you will have very little trouble. A dust bath of ample size, say four feet square and nine inches deep, half filled with sifted ashes and very fine dry sifted earth, should be placed in one of the back corners of the lower storey, which will form the scratching shed, in which your hens can free themselves from lice.

Scraping and scrubbing floors, dropping boards, and perches is a dirty and tedious business and anything which will make these oft-recurring tasks easier is well worth installing. So I recommend that the laying boxes should be removable and well off the floor as well as being outside the roosting house where they cannot be contaminated by the droppings. I also recommend that the hole in the floor through which the hens enter the upper compartment should be surrounded by a rim at least six inches high and that a board at least nine inches high should be placed at the edge of the wooden floor and between it and the wire netting under the perches. Both these should be easily removable for scraping and scrubbing and they will prevent the hens from scratching their litter into the lower compartment and leaving the floor of the roosting space bare, to be fouled by droppings which will be difficult to remove.

Before you place your fowls in their permanent home the floor of the roosting compartment should be covered with about two inches of litter and the floor of the lower compartment with about four inches of the same, after the dust bath has been placed in position and filled with ashes and fine dry earth. For the nest boxes I do not recommend hay or straw for India as they breed lice. It is better to cover the bottoms of the nest boxes with about three inches of fine dry earth. Before the hens are let loose in their quarters, whitewash all perches and wire netting as well as the floor and nest boxes, both inside and out. And don't forget to whitewash the under side of the floor as well as the upper. As an additional precaution the walls of the nest boxes should

be sprayed with a solution of DDT. You may then introduce your flock of hens and be quite certain that they are getting a fair start in life and that nothing has been neglected to make them clean and comfortable. However, it is not sufficient to start them off clean, they must be kept clean all the time if you wish to avoid trouble. Try to make your hens' condition of life correspond as nearly as possible to those which they would find in a wild state, with unlimited freedom and fresh air.

Feeding under these artificial conditions is exactly the same as for laying hens under more normal surroundings and has been gone into fully in the chapter on laying hens. A pen of twenty laying hens, which will need no cock, should get 30 oz. of mixed hard grain in the early morning, 24 oz. mixed hard grain at noon, and twenty oz. protein-rich mash in the evening. There should be sufficient feeding troughs to enable all hens to get their food simultaneously, that is why the whole front of the house is fitted with bars. As soon as the mash trays are removed they should be replaced by water troughs, well cleaned every morning and filled with clean fresh water. Before the hens are allowed to come down into the lower, or scratching compartment in the early morning their first feed should be scattered in the litter of the floor and this litter piled into a high heap in the middle. In demolishing this pile of litter and getting their grain out of it your hens will get a great deal of healthy and much-needed exercise.

Every opportunity should be given for taking various forms of exercise and no food should be given which can be had without working for it. A daily allowance of green food is absolutely necessary and this should be given by putting it into a trough made of wire netting placed so high off the ground that the hens have to jump to get it. It may be attached to the bars just inside the scratching shed. Remember that your object is to keep your hens active and muscular. Hens, like human beings, do not acquire muscles without exercise, and left alone their opportunities for exercise will be just about nil. So always be on the lookout to devise new expedients by which your hens will have to work for their rations.

GRIT: As hens kept under intensive conditions will have no opportunity of picking up the grit which is so necessary for their well being it is absolutely imperative that they should be supplied with an ample supply of the right kind of grit. This should be coarse sand from some nullah. Fine stuff is no good. If no other grit is available, which is hardly likely except in large towns, broken up crockery will do. This must be broken to the size of large peas, and all the fine sharp pieces sifted out. A soup plate broken in half might do for an ostrich but it is no good for hens.

LIME: Just as your hens will be cut off from grit in the confined quarters of their intensive house so they will be cut off from natural sources of lime and this must be supplied. Failing broken sea shells, or plenty of old mortar, the lime used with *pan* will do. But where lime can be obtained for betel chewing it should be available for hens in the form of slaked lime. Mind you do not give your unfortunate birds unslaked lime or they will die a horrible and painful death. If the lime you buy gets hot when you pour water on it, it is unslaked and you must sprinkle it with water and let it fall to powder and cool before you let your fowls get at it. Be sure you slake it all, as the process of adding water is called. If there are any particles of unslaked lime in it your fowls will have to slake it in their stomachs and the effort will lead to an untimely death. If quick, or unslaked lime, is kept for a long time in a damp climate it will slake itself. This is called air-slaking but it takes a long time and it is safer to slake it thoroughly with water. If you put too much water you only make the lime a little too wet and it will soon dry, whereas if you do not put enough you will leave parts of it unslaked and give your fowls a fit of indigestion from which they will never recover.

Remember the essentials for successful intensive poultry keeping:

1. **ABSOLUTE CLEANLINESS:** House white-washed at least once a month, floors and perches scraped and scrubbed before whitewashing. Drop-pings removed every two days. Litter renewed once a week. This may be paddy husks, chopped

hay or straw, or even moss and leaves, but it must be dry and finely chopped.

2. **PLENTY OF EXERCISE:** Grain ration always buried in litter, both morning and mid-day. Green food given with exercise.
3. **CORRECT RATIONS:** Mostly mixed grain, one ounce of mash per bird per day, containing one quarter of animal protein such as fresh lean meat (no fat), fresh blood, fresh fish (raw or boiled), cut green bone (best), blood, meat, or fish meal.
4. **GREEN FOOD:** An ample daily allowance of green food, cabbage, onion, beet, radish, turnip, or carrot leaves. Chopped carrot, turnip or onions. Lawn clippings, chopped grass, lucern, clover, green ground nut tops, barley, rice or wheat sprouts. Some green food every day is absolutely essential. Failing anything else the green leaves of trees will do.
5. **DUST BATH.**
6. **GRIT AND LIME.**
7. **CONSTANT SUPPLY OF FRESH WATER.**
8. **FREEDOM FROM DAMP:** But plenty of fresh air and a tight roof.
9. **REGULAR MEALS.**

If there is any possibility of letting hens kept under intensive conditions out for a run in some large open space of ground, this should always be done and no opportunity, however short, should be lost of giving them their liberty. As these hens will have no opportunity of finding any insects or green food for themselves particular care must be given to these two vital articles of food, without which no flock of hens can prosper and lay abundantly.

CHAPTER XIII

MANAGEMENT OF BREEDING STOCK

SUCCESS in poultry keeping depends very largely, to say entirely would hardly be an exaggeration, on the kind of stock you start with and how you treat it when you have got it. As first class breeding stock of a pure breed, and also of a good egg-laying strain within that breed, is very expensive and difficult to get hold of, it behoves the Indian poultry keeper to do his utmost to get the best out of it by every means within his power. In keeping laying hens the object is to get the maximum output of eggs with the minimum reasonable outlay, but it is false economy to stint capital expenditure on suitable houses or to endeavour to economise by giving cheap or unsuitable food. But with breeding stock it is far otherwise. Eggs intended for sale as food only need to be fresh and of good size and appearance, fertility and vigour of the germ contained with the egg being of no importance. In fact, infertile eggs keep much better than fertile ones and cocks running with laying hens are a positive disadvantage. However, with eggs for hatching purposes, purity of breed and strain, fertility, and vigour of the germ are of paramount importance. With laying hens purity of breed, provided the hens are heavy egg-layers, is of secondary importance and hybrids are very often more fertile and robust than either of the breeds which were crossed to produce them. But hybrid-vigour is not possible in a pure breed. Whatever vigour is present must be obtained by the individual vigour of the parents and this vigour is to a very large extent a function of the environment in which these parents are reared.

With laying hens environment does not count for so much as the number of the eggs they lay. They are only destined to be eaten. With breeding stock, environment counts for almost everything. Because it is the environment in which breeding stock is reared that determines their health and

vigour and therefore the health and robustness of the chicks which are hatched from the eggs they lay. Breeding birds are kept solely for the fertile and viable eggs they lay and for no other purpose. It is therefore not so important that they shall lay the largest possible number of eggs of any old quality but that they should lay the largest number of eggs of the highest excellence from the breeder's point of view, which is a very different matter.

As fertility is of the utmost importance it is not advisable to allow a cock to run with more than ten hens. Ten hens and one cock therefore make the ideal breeding pen. Pullets lay the largest number of eggs in their first laying season, but it has been found by experiment that the eggs of young hens do not produce chicks which are so robust and have such a high percentage of live hatchings as the eggs of more mature birds. So it is best to breed from birds which have passed their first laying season and are about two years old. The same applies to cocks. As you will naturally wish to transfer your best and most healthy hens to your breeding pen you will keep all your pullets under observation during their first year and choose only those which as well as laying the largest number of eggs, are the most active, alert, and muscular. It is considered that pullets which lay a very large number of eggs in their first year, soon exhaust themselves and during their second year produce eggs which are not so likely to be fertile and produce robust chicks as other pullets which lay a smaller number of eggs in their first year and a larger number than normal during their second. For the purpose of selecting breeding stock, the trap nest is almost essential. Nobody, except a phenomenon, can keep in his head a perfectly correct record of the number of eggs laid by each of a large flock of hens. But by having trap nests in the laying house, which detain laying hens until they are released, and marking each hen with a numbered ring round her leg, it is possible to keep a perfectly accurate record of the eggs laid by each hen, and this record, combined with a careful scrutiny of the health and general behaviour of each individual hen, is a sound basis on which to select your breeding pen or pens.

IMPORTANCE OF STRAIN: In buying breeding stock

it is not sufficient to insist on getting birds of a pure breed. Hens, although of a pure breed noted for its high egg laying characteristics, may not necessarily be high, or the highest possible, egg layers within that breed. Which is precisely the very thing you require for breeding purposes. Think it out for yourself. All hens of any particular breed are unlikely to be all equally good egg layers, and they certainly will not be unless they have been most carefully culled and the poor layers and less robust birds mercilessly rejected. If the only thing you insist on in buying breeding birds is purity of breed, say that they should be White Leghorns or Rhode Island Reds, all you are asking for is a flock of birds of a certain breed which is, generally speaking, noted for certain qualities. You are asking nothing about exactly how many eggs per bird you may expect to get in the first two laying seasons, after which very few hens, of whatever breed, lay enough eggs to pay for their keep. However, if you specify White Leghorns, Rhode Island Reds, White Wyandottes, Barred Rocks, or whatever breed you fancy of a STRAIN which will give a guaranteed production of, say 200 eggs per laying season, you know precisely what it is that you are getting. A breeder who supplies you with a pure breed merely to your specification that the birds must be all pure bred, can, and probably will, sell you all the birds which he could not pass off onto a more discriminating buyer. He has no obligation to select for you all his best layers. You have only asked for pure bred birds and you have got them. The fact that they do not lay to your expectations is your fault and due to your ignorance in not insisting on a high egg-laying strain and in failing to specify how many eggs you expect to get from each bird in each season. In buying birds for breeding purposes do not make this mistake. You have been warned!

Having obtained the best birds available, and only the very best are worth breeding from, it is up to you to get the best possible value out of them. And this means the largest possible number of vigorous and fertile eggs safely converted into live and robust chicks. This can only be ensured by keeping your breeding birds on an extensive free range liberally supplied with grass, bushes, and insects and changing

the area over which your birds roam at frequent intervals. Hens for egg-production can be kept in confined spaces and under highly artificial conditions but breeding stock cannot. If you are unable to give your birds free range over grass it is hopeless to try to breed healthy high production poultry and you would do better to buy your laying pullets and confine yourself to egg-production, or one of the other branches of the business.

AREA REQUIRED: I consider the minimum space required for each bird of a breeding flock is ten square yards. For the purpose of this calculation you can exclude the cock and call the space required for a flock of ten birds one hundred square yards or an area ten yards (30 feet) by ten yards, frequently changed. I advise you to lay out three plots, each ten yards square, in a straight line and situate your hen house in the middle, in such a manner that your breeding hens can be turned into any one of these plots as required. You will then let your birds run for some months in run No. 1, while you plant the other two with any fast growing green food that is obtainable locally. I recommend groundnuts. They grow fast, are very hardy, will grow in poor sandy soil, and require very little rain. Although they will not grow with no rain at all unless they are irrigated, this can be done with a watering pot, hose, or lawn sprinkler. Groundnuts give a very large and very succulent crop of the right kind of green stuff for fowls, but they should only be planted on part of the available space, the rest being occupied by grass, so that the birds do not get a green food diet exclusively of groundnut leaves and shoots. As soon as your groundnut crop, or whatever you decide to grow, is ready in No. 2 plot, the fowls are turned into it, while you replant plot No. 1. By the time the hens have finished the green stuff in plot No. 3 the plants in plot No. 1, will be ready again and in this way you will ensure uncontaminated ground for your breeding birds to run on and also unlimited green food of the right kind. After a time the birds' droppings will have enriched the ground to such an extent that you will be able to grow the most luxuriant crops on it.

ACCOMMODATION: For your breeding pen I recommend the largest house you can afford. For a pen of ten

hens and one cock I used a house eight feet square, built of cement-asbestos sheets on hardwood frames. I chose these dimensions because I could make all the sides I wanted covered out of single sheets of eight feet by four feet sheets without cutting them and thus wasting material. For the hen houses in breeding pens I adopted a design with open sides and front and a closed back. There was a substantial door in the front and the rest was all wire netting. This wire netting was firmly embedded into a cement floor and the house was always kept locked. In this particular case I had a row of inside nest boxes with a steeply sloping roof on which birds could not roost or perch and the perches were so arranged that droppings from roosting birds did not fall on the roof of the nest boxes but onto a sheet of corrugated iron from which they could be tipped into a bucket every day. The inside nest boxes and netting embedded in cement were for the purpose of preventing the theft of valuable eggs, and also in order to make the hen house as proof against rats, cats, etc., as possible. However, I regret to have to admit that my eggs were none the less stolen, in spite of doors locked with Yale locks of the best quality, and every other conceivable precaution. I only succeeded in defeating the rats and cats. The door should have a plank about six inches high across the bottom, over which one has to step, and against which the door must fit closely. This is to prevent rats from gnawing away the bottom edge of the door and thus finding their way in. If the cement-asbestos sheets and wire netting are both bonded firmly to the cement floor this is the only place where rats can get in.

Having made all your preparations and let your breeding flock loose in their pen you will naturally wish to use the eggs as soon as possible, but you must remember one thing. Eggs cannot be guaranteed to be fertile and hatch a chick every time until the cock has been running with the hens for ten days. It has been found that some eggs are fertile after only four days, but on the other hand, some are still infertile after a whole week. So to be on the safe side, do not try to hatch any eggs until your birds have been running together for ten days. After a cock has been separated from his hens for some time they will still continue to lay fertile eggs for

ten days, but a longer period should not be risked. I strongly recommend that all eggs from a valuable breeding pen should be hatched in an incubator. They are too valuable to risk as they are out of the shell. Of course, cocks vary to a considerable extent and some can cover more hens than others, especially during hot weather. If a cock is running with too few hens they will soon show signs of it by running away from the cock, a general air of restlessness, and sometimes by losing the feathers from their backs. So for the first week or two your breeding pen should be kept under careful observation. If there are obviously too few hens for the particular cock mated to them, either the number of hens should be increased or the cock separated from them, say until mid-day. As with hens so with cocks, very young cocks should not be used for breeding purposes. A cock should be at least two years old before he is admitted into a breeding pen, but quite elderly cocks are often responsible for fertile eggs.

FEEDING: There is no difference in the feeding of breeding stock. What is good for laying hens is equally good for hens which are called upon to produce eggs for hatching. If the precautions mentioned in previous chapters about supplies of fresh water, grit, lime, and dust baths are faithfully carried out the same ration which is suggested for laying hens will do for your breeding pen. In their case, however, as they will have a spacious run, the hard grain ration may be scattered widely among the grass instead of being buried in litter. Sometimes cocks are so anxious to see that their hens get enough to eat that they do not eat enough themselves. If this is noticed to be the case, your valuable breeding cock may become debilitated and sterile, so he must be fed separately.

TRAP NESTING: As by the time your hens arrive in the breeding pen they will have already been carefully selected, there is no need to use a trap nest for them. Their trap nesting days are over and they have passed the test. The trap nest will have been used to weed out the poor layers during their first laying season. However, given hens of equal laying capacity, it is necessary to choose the ones which are most likely to pass on their high egg-laying capacity

to their progeny, and you will need to know the kind of hen to select from the whole of the first-year birds. A good robust mother is known by her intelligent and alert look and her activity and eagerness in foraging for food. Her head and tail are carried high and she has bright and observant eyes. Her plumage should be firm and glossy and her legs smooth and bright, not rough and scaly. If she is a laying hen she will most certainly have a bright red and semi-translucent comb of fine texture. A coarse, dull, meaty comb, or a granular looking one are bad signs and any hen showing them should be unhesitatingly rejected. Eagerness for food is one of the best indications that hens are in a fit state of health and in good fettle for egg laying. If they are observed to be off their feed and show no eagerness at feeding time it is either a sign that they are unwell or that they are getting too much to eat, and their ration should be immediately cut down until they show their original eagerness for every meal. The best way to do this is to omit their mid-day meal of hard grain for at least a week and watch the result. They may be getting so much food from their run that they do not need it at all. However, if after a week they take their mid-day feed again with their former enthusiasm it should be restored. But great care should be taken not to over-feed breeding stock. Fat hens produce few eggs, and those that are produced will not hatch healthy robust chicks.

CHAPTER XIV

HOUSING

SLAVISH copying of hen houses designed to suit the English and American climates is not going to help the Indian poultry farmer much. To begin with, these houses will be unnecessarily expensive, and besides, they will be totally unsuitable for climatic and other local conditions prevailing in this country. The fowl is essentially a tropical bird, indigenous to India, Burma, and the Malay States. In these countries, in spite of heavy monsoon rains, it is living under conditions ideally suited to its habits and constitution. In India, fowls require no special precautions to protect them from the rigours of a climate against the severity of which evolution has adapted them. The northern parts of America are swept by blizzards of snow and wind and are subjected to prolonged periods of sub-zero temperature which would very soon prove fatal to the hardiest hen where no adequate protection provided. No such conditions prevail in any part of India, or the adjoining countries. The English winter is not so severe, but snow, ice, and bitter penetrating winds are common, combined with cold wet spells which are even more unfavourable to health than the cold dry winters of America.

Indian poultry keepers, although they are not called upon to battle against snow and ice, and have not therefore to build snow, cold, and windproof houses, have none the less to contend against other and equally disconcerting disabilities of a different kind, for which an entirely different type of house is required. On account of the warm and equitable climate of most parts of India, vermin and diseases breed apace and the design of poultry houses must aim at eliminating these profit-consuming pests as far as possible, rather than at protecting the birds from non-existing drafts and cold. It will thus be seen that poultry houses for India and other eastern countries must be designed on totally different lines

from those of their English and American counterparts. This is a point which is ignored by most writers on poultry farming in the East.

The points to be kept in mind when designing poultry houses especially suited to the Indian climate and conditions are as follows:—

1. Provision for protection from damp, ample space, and plenty of fresh air.
2. Protection against disease and vermin (chiefly lice).
3. Protection against rats, theft, and wild animals.
4. Ease of cleaning and maintenance.
5. Ease of construction with the minimum of material, elaborate fittings, and skilled craftsmanship.
6. Adaptation of design to sizes and dimensions of material locally available.
7. Use of modern hygienic materials as far as possible.
8. Provision of all possible labour saving features.

This may seem a formidable list of requirements but it can be met with comparative ease by very careful attention to design and construction. A word of warning here. Be quite certain that you understand the construction drawings before you actually commence building. I strongly advise prospective constructors to make a model of the particular house they propose to build before ordering materials or making contracts. This model can be made of cigar-box wood or even of paper and cardboard, fastened with a paste made from rice boiled until it is a thin gruel.

Timber is scarce in India and getting scarcer, therefore the less you use it the better. In some places it is almost unprocurable, so substitutes must be used wherever possible. Fortunately this can be done to a large extent. The most careful attention must be given to protection against termites (white ants), that most destructive pest of all wooden structures.

In considering the matter of cost first, it may seem to some that asbestos-cement sheeting is a very expensive material in comparison with wood. However here are the correct facts. Sum up the situation for yourself. Indian timber is mostly hand sawn, and very badly hand sawn at that. Scantlings

are never true to size. They are neither straight nor square and the cost and waste of time involved in truing them up from pieces much larger than necessary is colossal. Remember that the cost of labour is the most expensive item in all constructions made by hand. Planks are no better. They are neither of uniform thickness nor width, and they are mostly split, warped, twisted, and unseasoned. In dressing them to a uniform size and thickness by hand they will lose, at least, one quarter of their substance, if not more. The cost of labour will just about double the original price of the material. And, most important, they will not be white ant-proof.

Compare these disadvantages with the convenience of asbestos-cement sheets. The present cost of this material is about As. 4 per square foot. It comes to you in convenient sheets, 8 ft. by 4 ft., of uniform thickness and size with all edges clean, straight and square. And, it is completely proof against white ants, rot, mildew, and boring insects. If you add to these obvious advantages the fact that it requires no paint or other treatment to protect it from the weather and that it offers no cracks or crannies to harbour lice its advantages will be apparent.

If the dimensions of your poultry houses and appliances are so calculated (as they are in the designs suggested in this book) as to fit the size of a 8 ft. by 4 ft. sheet, there will be no waste. In some cases the sheets are used just cut across once, in others they are cut up in such a manner that there will be no waste at all. In cases where the cutting is rather complicated a diagram is given showing how the sheets should be cut in order to avoid waste. I suggest that you mark out a sheet of stout paper, 8 inches by 4 inches, and cut this out square all round. You should then draw on it the cutting diagram, cut the pieces out with a pair of scissors, and fit them together to form a paper model of whatever you intend to make. This will give you confidence when explaining to a carpenter just how to cut up the larger sheet and fit the pieces together. Once you have grasped the idea you will find that the use of these sheets will enable you to build fowl houses and apparatus with extraordinary speed and economy.

Now a word about buying timber. Short pieces are much

cheaper than long ones. As most of the houses and apparatus described do not require long lengths of timber (except the tie beams of the larger laying houses) you can buy all the material you require in short lengths, provided they are of the width and thickness specified. In making plans for nest boxes, as few sizes of plank as possible have been adopted. But where planks two inches by three quarters are shown there will be no harm in using pieces three inches by one inch if they are more easily and conveniently procurable. In the nest boxes there are no pieces longer than eight feet, so you will be safe in buying pieces and planks for these in lengths of about nine feet, to allow for split ends or squaring off the ends accurately.

In making the roof trusses for the largest laying house you will observe that the span is twenty-four feet and the tie beams will have to be about three feet longer than this. Twenty-seven feet is a long length and likely to be difficult to find. So you may use two lengths of fourteen feet each, fished or spliced in the middle by nailing a six foot length of the same dimensions over the joint.

The roof trusses used in these houses are rather peculiar and are of my own design. I have not seen them used by anyone else, so I must explain how they are put together. The ends of the principal rafters are only cut off square, they are not shaped in any way, to save labour. The king posts are much wider than in most roof trusses in order that they may be notched for the upper ends of the principal rafters without loss of strength. The king post is just notched for the ends of the principal rafters and they are laid in place, nailed with long nails and a piece of plank nailed on each side and then cut off to conform to the slope of the principal rafters. The tie beam is composed of two planks, six inches by one inch, just nailed over the principal rafters and king post. This allows the principal rafters to project beyond the walls of the house to form overhanging eaves, without any constructional complications. If you intend to use tie beams in two lengths, they must meet on the centre line of the king post and should be nailed to it. Two liners about three feet long and the same thickness as the king post, are then inserted one on each side of the king post, between the two

planks which form the tie beam. A six-foot length of plank is then laid over the joint, projecting equally on both sides of it, and this is strongly nailed with four-inch nails through the joining piece, the tie beam, and the liner. The truss is then turned over and a similar splicing piece is nailed to the other side. The king post should be of 12 in. by 3 in. material, the principal rafters 4 in. by 3 in., and the tie beams planks 6 in. by 1 in. These trusses should be placed immediately over the posts of the houses and held in place by planks, 6 in. by 1 in., to the top pieces of the sides. The purling, which supports the corrugated iron roofing sheets, need not be larger than 3 in. by 2 in. There should be one purling at each end of the sheet and one in the middle.

In the smaller houses cross bracing will not be necessary but in the larger ones, which have open sides covered with wire netting only, the corners must be cross braced as shown, or the whole house will get out of square and possibly get blown down.

It is not necessary to adhere rigidly to the dimensions mentioned in this, or any other book, provided the same floor space is allowed per bird. For instance, it is recommended that for intensive poultry keeping in India not less than five square feet of floor space should be allowed per bird, and that the house should be not less than six feet high. This means five feet of floor space under cover in the scratching shed and has nothing to do with the run, if provided. A house ten feet square is suggested for a flock of twenty birds. This gives a total floor space of one hundred square feet, 10 multiplied by 10, which is exactly five square feet per bird. This is, of course, the minimum. The more space you can afford to supply the better. If the house is six feet high it will have a total content of six hundred cubic feet, which works out to thirty cubic feet per bird, for twenty birds kept in total confinement.

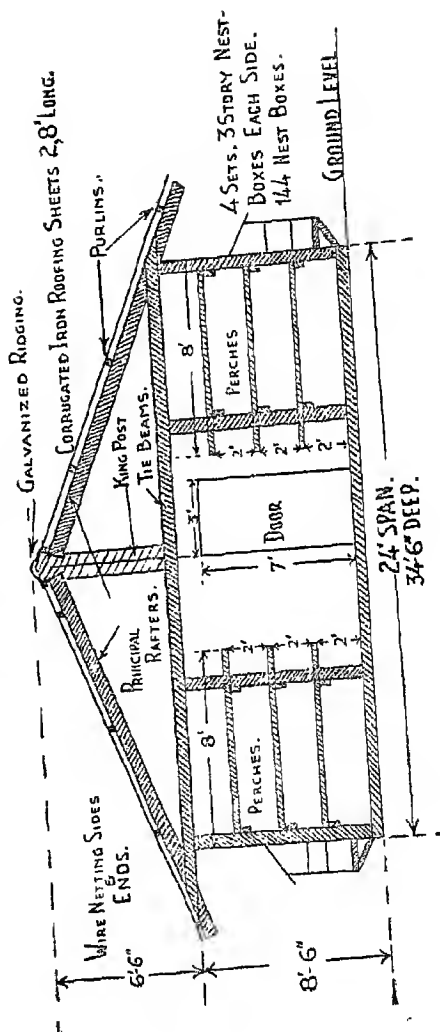
Now a house ten feet by ten feet does not fit the dimensions of sheets which measure 8 ft. by 4 ft. very well. They would have to be cut. But a similar house which is 8 ft. by 12 ft. can be constructed of these sheets without any cutting at all and the floor space will be 8 ft. by 12 ft. or 96 square feet. This does not allow exactly five square feet per bird

PLATE II

PLAN FOR FOWL HOUSE FOR 400 LAYING HENS.

SCALE: $\frac{1}{4}$ " TO 1'.

TRANSVERSE SECTION.



but it is quite near enough. The roof is the only difficulty. A short piece will have to be added to span it and provide some overhang. The great advantage of this system of construction is that, provided the sheets fit the dimensions exactly, there is no fuss and bother about cutting and dressing them, they are simply put in place and nailed on. There will be no wasted material or labour. You will get full value out of both.

We will now take the requirements of Indian poultry house and explain how they are to be achieved with the least trouble and expense. The first requirement is a permanently water-tight roof which will not harbour lice, as a thatched roof will, and will also be durable and fireproof. For this nothing is better than cement-asbestos sheets one quarter of an inch thick, or twenty four gauge corrugated iron sheets. For intensive houses, in which the birds remain all day as well as night, it is necessary to keep them cool and perhaps cement-asbestos combined with ample ventilation will be best. For a laying house in which the birds only perch at night or go to lay, I consider corrugated iron the most suitable, especially if the house can be built where it is shaded during the middle of the day. Corrugated iron is very quickly and cheaply placed and extremely durable, especially if painted.

If you use cement-asbestos sheets, which have to be laid overlapping, be sure to use a wedge-shaped piece of wood under the upper sheet where it joins the one below it. If you do not do this the upper sheet will break along the line where it is not supported. Roofs of this material should be either tarred or treated with some sun resisting paint such as "Siderosthene" because they are liable to absorb moisture. Good ventilation and plenty of fresh air are achieved by making all the walls, except the back, of wire netting. In cold places like the northern Punjab or the hills, three sides should be enclosed and only the front covered with wire.

FREEDOM FROM DAMP: This is important at all times and places but more especially in those parts of India which are exposed to a prolonged and severe monsoon. Roofs should have a considerable overhang on all sides, two feet is none too much, in order that the rain is not blown into the house, where it will take a very long time to dry off. In

places where there is a high and continuous wind accompanying the rain all houses should be placed with their enclosed backs towards the wind. If this is not possible it may be necessary to fit boarded screens, extending from the eaves to about three feet below them, to ward off the driving rain. These may be made removable and discarded in the fine season. Freedom from damp is also secured by making the floors of the houses at least six inches higher than the surrounding ground, so that it is impossible for the floor of the poultry house to get flooded and any water which drives in soon drains away. With permanent houses it is best to make the floors of cement concrete not less than three inches thick and to embed the wire netting of the sides firmly into it. This will effectually prevent the entry of rats and other larger animals. In building wire framed houses the wire netting should be carried over the top at the level of the eaves. You may consider this unnecessary with a corrugated or cement-asbestos roof. But the fact is that no roof of this kind can be made impervious to rats, mongoose, or jungle cats. The complete wire netting cage is an essential precaution. For the same reason the door, in fact all doors, should close against a coaming. This is merely a piece of plank about six inches high fitted against the door posts and forming a low barrier over which you have to step in order to enter the house. The door shuts close against this step and prevents rats from getting in by gnawing away the lower edge of the door. This they always do, if not prevented.

While we are on the subject of precautions against pests and diseases I must mention the matter of overcrowding. Nothing helps spread of disease more than overcrowding. Damp, dark, filthy, and grossly overcrowded houses are, I am sure, the cause of most of the poultry diseases which periodically devastate the fowls of India. It stands to reason that fowls which are crowded closely together in an environment which encourages the growth of microbes are certain to communicate diseases from one to another and so throughout the flock. Birds which have ample room and can perch wide apart are very much less likely to spread disease. In any case, in commodious houses the disease will make much slower progress and it may be possible to check it before it has

done much damage. You may consider that my designs are too ambitious and offer far more room than is necessary. This is very far from being the case. The amount of space recommended is the minimum which will ensure healthy and hardy birds, free from lice, coughs, colds and other contagious diseases of a more serious nature. It is better to have a big house than a dead flock. You will notice that perches on the same level are placed four feet apart, giving ample room for the circulation of air between perches. Vertically the tiers of perches are placed two feet apart for the same reason and here is an important point. You must not place one perch vertically beneath another. The reason, of course, is that if you do the droppings of the bird above will fall on the head of the bird below. For this reason you will notice that in all designs the perches are staggered in such a manner that no perch is under the one above. The minimum distance between perches should be twelve inches, but sixteen is better and this is the distance which has been adopted in the largest laying house. You will observe that there are variations in the designs in order to give a variety of choice. If you prefer some feature of another house there is nothing to prevent you from incorporating it into the house which you decide to build. Or adding brain waves of your own for that matter. These designs are only suggestions. When thinking up improvements consider the essentials: ample accommodation, free circulation of air, birds not crowded together on closely spaced perches, tight roof projecting well all round, a clean, hard, impermeable floor, remaining dry in the wettest weather, no lodgment for lice, rat and cat proof, plenty of room inside to do cleaning and spraying without knocking your head against dirty perches, a well fitting door shutting against a coaming, floor of house raised well above surroundings.

FREEDOM FROM LICE AND DISEASES: Microbes of all kinds delight in dark, damp, and dirty surroundings, in which they multiply at an alarming rate. The object of having poultry houses which are entirely enclosed with wire netting and nothing else is precisely to provide so much air and sunlight that all vermin and disease germs are discouraged, although they cannot be entirely eliminated. The

object of a floor raised well off the ground is exactly the same, to keep the birds' feet dry and free from adhering mud full of germs and the eggs of intestinal worms (nematodes). The drier your fowls' feet and legs are the healthier they are likely to keep. One of the greatest advantages of cement-asbestos sheets is that being made entirely of mineral (or inorganic) materials they afford no nourishment or harbourage for germs and form an uncongenial habitat for lice and other insects.

Having one smoother side, which should always be placed inwards except when used for roofing, these sheets are easily kept clean. If they are regularly sprayed with whitewash mixed with phenol or some other powerful disinfectant they can fairly easily be kept free from lice. The whitewash, when sprayed, fills up the crevices and crannies in which the lice hide and breed. Spraying with DDT solution, is also a very good thing because it kills flies, mosquitoes, and other insects which are carriers of disease not only to hens but equally to humans. Although this matter has not yet been satisfactorily proved it is suspected that lice, ticks, and rats are responsible for the spread of many of the diseases, epidemics of which are so liable to sweep away the fowls of whole districts before they exhaust themselves for lack of further victims. So the best way to keep your birds hard and healthy is to make it impossible for either rats or vermin to obtain access to them, and to see that their feet are kept dry at all times. Remember that hens can't wash their feet like you can and contamination once contacted remains attached for days with any amount of opportunity for penetrating some slight abrasion or passing on to another bird or birds.

PROTECTION AGAINST RATS, THEFT, AND WILD ANIMALS: By having a cement floor with the wire netting embedded well into it, continuing the wire right over the roof, and having a well-fitting and substantial door closing against a coaming and fitted with a good stout lock, ample protection against animals both large and small will be assured. The matter of theft still remains to be dealt with and this is a different and far more difficult problem. Personally, in spite of locks, bars, bolts, and every other pre-

caution, I have never succeeded in preventing the loss by theft of a certain proportion of both eggs and mature birds. The chicken stealer is always with us and the only protection against him is strictly closed premises, good and none too friendly dogs, and eternal vigilance.

PROVISION OF ALL LABOUR SAVING FEATURES: This is one of the most important points in poultry keeping. Normally there is so much tedious and exacting work attached to poultry farming on a large scale that every effort should be made to eliminate as much as possible of it, by careful design and layout. All poultry houses should be so designed that they can be maintained and the birds fed and watered with the minimum of effort. By effort I do not mean tossing two hundred pound grain bags about as if they were pats of butter but the ordinary daily routine of doddering round the farm opening numerous doors and gates and walking backward and forward with heavy pails of water, removing droppings, and doing the hundred and one things that have to be attended to over and over again. The ideal to aim at is so to lay out your farm that the poultry keeper has to make but a single round every time he feeds and waters his birds. In order to save labour to the utmost it should be possible to both feed and water the birds without having to open any gates or doors. This can be accomplished by placing bars, spaced $1\frac{1}{2}$ in. apart, along a portion of the fence and placing the feed on a low platform just outside so that the birds can thrust their necks through the bars and reach the food without leaving their pen. To feed several hundred hens in this manner is no easy task but it might be worth trying. In any case it should only be necessary to open one door in each pen.

Then there is the periodical removal of droppings and the cleaning, scraping, spraying, and disinfection of the houses and their fittings such as perches and nest boxes, as well as the inside of the houses when they are provided with walls. All intensive houses should be so designed that the birds can be fed and watered without opening any doors. This has been attended to in the designs for such houses given in this book. All perches should be removable for scraping and lime-washing. This can be done by fitting perches into semi-

circular notches cut in the perch supports. Be careful to make the perch supports amply strong because these notches will weaken them considerably, and a single perch full of roosting birds may weigh well over fifty pounds. The size of these perch supports should not be less than 2 in. by 6 in. with a notch about $1\frac{1}{2}$ in. deep. Nest boxes should be removable for the same reasons. All designs illustrated in this book are fitted with easily removable outside nest boxes, so placed that they cannot get fouled with droppings and are easily emptied of their eggs without entering the laying house. Easily accessible droppings boards of corrugated iron should be placed beneath all ranges of perches. The droppings can then be very conveniently and quickly removed by lifting the light corrugated iron sheets individually and tipping the droppings into a box. Laying houses have been designed to give ample room for this operation. The sheets are all eight feet long which is a fairly handy size to manipulate. Where these dropping boards are not used I recommend that dry litter should be spread on the floor, especially if the floor is of rammed earth. This will keep the birds' feet clean and dry and also prevent the droppings from adhering to the floor from which they are very difficult to remove.

EASE OF CLEANING AND MAINTENANCE:

Smooth asbestos-cement walls do not harbour vermin and are easy to keep clean and to disinfect when necessary. Smoothly rendered cement floors are impervious to droppings which, if the floors are periodically scraped, cannot accumulate on them. This is not the case with earthen floors however well rammed. The droppings penetrate into them until they become so foul and full of germs and the eggs of intestinal worms that they have to be dug up and renewed. In any case they are a continual source of infection and should be avoided like the plague. For general satisfaction and ease of maintenance I strongly recommend cement floors for all houses however small. If earth floors must be used they should be covered with a layer of litter from three to four inches thick and this should be renewed once a week or oftener if it gets too dirty. All perches and nest boxes should be removable without having to extract nails. They must be periodically scraped and whitewashed.

No part of the internal walls should be screened by nest boxes or non-removable fittings of any kind. It should be possible to spray every inch, both inside and outside, without having to remove anything except perches. The nest boxes specified in this book are so devised that every part both inside and outside can be sprayed without dismantling.

When you are considering the design of your poultry house, or houses, picture yourself going through all the motions of feeding, watering, cleaning out, collecting eggs, and disinfecting. Then introduce every little contraption you can think of which will save you, or your employees, any unnecessary trouble or moving about. Remember that most of these tasks have to be done every day and some of them more than once a day. So a little time and trouble saved on each petty task will amount to a good deal of time by the end of the day's work and very much more during the course of a whole year. And, time is money. You either have to do the work yourself or pay someone to do it. The less work he has to do the less you have to pay for.

Individual tasks on any poultry farm will vary according to its layout and the kind and number of fowls kept. It is therefore impossible for me to tell you exactly how to save yourself the most trouble. I can merely indicate to you the kind of things which require attention and consume valuable time and leave it to you to devise means for making these jobs easy. The general idea being, of course, to save yourself as much walking about with heavy weights as possible and to avoid going over the same ground twice. Make your farm building as compact a unit as possible.

EASE OF CONSTRUCTION: No building however simple and unpretentious, can be cheaply constructed unless you first consider what materials are most economically available locally and what the standard dimensions of these materials are. I have strongly recommended cement-asbestos sheets but I know perfectly well that they will not be available in all parts of India and other eastern countries. That is why I have designed houses which can be constructed mostly of wove netting stretched on a wooden frame. This entails the minimum of woodwork and other materials. However, where cement-asbestos sheets are procurable, use them

and where they are not use whatever material is most easily and cheaply available in your locality, using wire netting as largely as possible. Doors can, of course, be covered with wire. That is why they are shown as three feet wide.

Firstly, I will explain the best way to use cement-asbestos sheets. They are sold in one standard size, 8 ft. by 4 ft., and in thicknesses of from three-sixteenths upwards. For walls and small appliances like coops the three-sixteenths inch weight is quite satisfactory but for roofs the quarter-inch thickness is necessary. All kinds of appliances can be made of these sheets with the minimum of woodwork—coops, brooders, nest boxes, houses, and food storage sheds. Rats do not enjoy gnawing them as they do wood and termites (white ants) take no interest in them whatever. If it is desired to make them absolutely impervious to water, as in the case of roofs, they should be either tarred or painted. These sheets have to be supported at every two feet, so make your main uprights eight feet apart, centre to centre, so that the joint between sheets comes exactly on the centre line of the main uprights. At every two feet between these main posts place 3 in. by 2 in. battens. A horizontal batten, which can be a 2 in. by 1 in. let in flush with the surface of the three by two should be placed at every two feet. The best way to fasten these sheets is by nailing a two-inch by half-inch batten over the joints and supporting battens, both horizontally and vertically. Nails are inclined to rust and pull through this thin material. Dimensions of all buildings constructed of these sheets should be multiples of eight feet or four feet. For instance, twelve feet by sixteen, twenty by thirty-two, and so forth. Houses of the lean-to type can be ten feet high in front and eight feet at the back, the triangular piece at each side being filled in with wire netting for ventilation. If the dimensions are multiples of four, such as sixteen feet by twelve feet, the whole house can be built without cutting a single sheet, except where the door comes. And this can be made four feet wide and seven feet high, only a slice one foot wide being cut from one end. By keeping these principles in mind and giving the matter considerable thought it should not be too difficult for the average poultry farmer to design his buildings and apparatus to suit

his own particular requirements, if he fails to find anything suitable in this book.

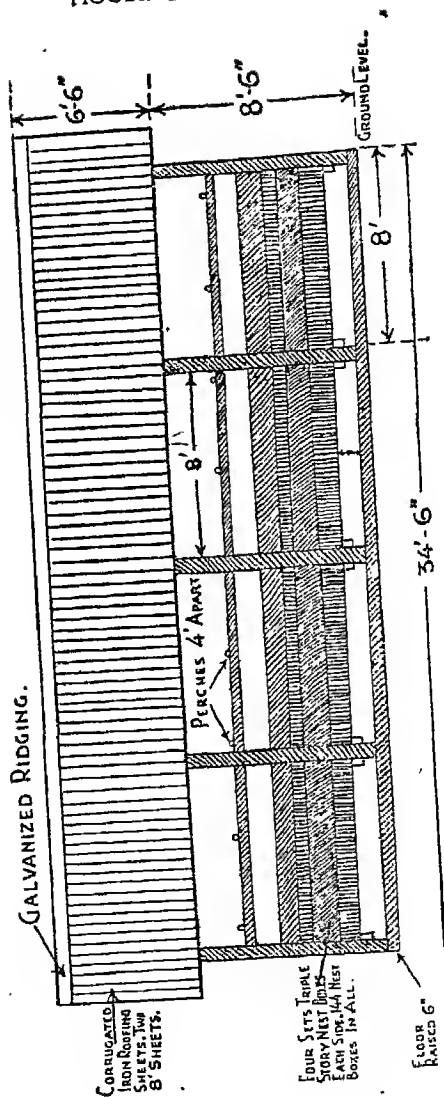
Wire netting is obtainable in rolls of fifty feet and of different widths three feet to six feet. The length varies somewhat depending on the country of origin. The best mesh for poultry houses is one inch and the wire should not be less than twenty gauge or it will be too weak for durability. For the enclosures of coops and other apparatus to contain small chicks the mesh should be half inch and a smaller gauge of wire is permissible. I do not recommend hen houses with anything but wire netting sides and a good tight roof for any part of India, except as mentioned, so it should not be too difficult or expensive to put up a perfectly satisfactory building in any part of India or the East generally. For the frame it is quite permissible to use round poles but they should where possible be of white ant resisting timber. If this is not procurable, the ends of the posts which are to be buried in the ground, and for a distance of about four feet above this, should be charred. This is done by putting the ends of the poles into a good roaring fire and keeping them there until they are well alight. The part which has been converted to charcoal, which should not be more than about one-eighth of an inch thick, should be scraped off. The burnt end, while still hot, should then be well tarred, special attention being given to the cut part. If there are any cracks not filled with tar, or any untarred portions the termites will get in and eat out the centre part of the post to the top. Creosote or one of the commercial brands of wood preservatives can be used with equal effect. If tar is to be used, the hot post end should be plunged into a deep container of tar and left in it for about ten minutes. The post can then be allowed to stand in some shallow receptacle to drain, the surplus tar being used for other posts.

As I have said before, all you need for a laying house is a wire covered cage with a good roof, large enough to allow not less than two square feet per bird, and high enough to permit you to enter it without stooping. The actual shape and design are of secondary importance as long as the perches are not placed one over the other and the nest boxes are accessible from outside. For the sake of economy it is best

PLATE III

PLAN—OF LAYING HOUSE FOR 400 HENS
SCALE: $\frac{1}{4}$ " TO 1'

SIDE ELEVATION.



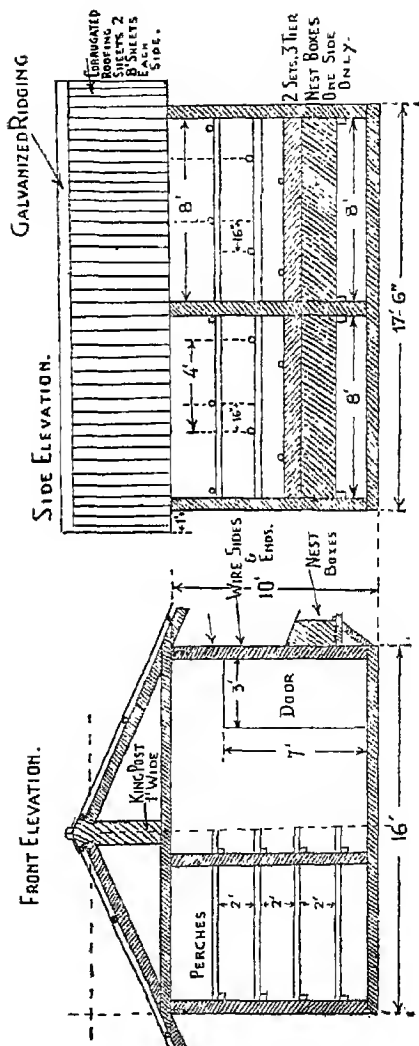
to make these nest boxes in sets of six. Each set will then be exactly eight feet long. If your posts are to be six inches square or six inches in diameter, place them eight feet six inches apart, centre to centre. A set of nest boxes will then just fit between each main post. Be careful to allow a certain amount of extra space, say one inch, to permit you to fit in your nest boxes without jamming. It will be best to make your nest boxes first and try them in place when you are setting up your posts. You will then not have the mortification of having to pull down the whole building in order to fit your nest boxes. All that remains to complete a practical and excellent fowl house, perfectly suited to the climate of India, is to make a good hard floor. If cement is out of the question, place corrugated iron droppings boards under the perches. These will catch most of the droppings and keep the floor sweet for a considerable time. If lime is cheap in your district a lime concrete floor may be substituted for the cement one. The better the floor the healthier your hens are likely to be. It is poor economy to have a floor which is impossible to keep clean. The trouble and expense of periodically digging out an earth floor and replacing it will very soon exceed the first cost of a good cement floor. Don't forget that this floor should stand well clear of its surroundings, six inches higher is the least you should allow. I have emphasized the matter of a good floor because I am convinced that damp and dirty floors are responsible for most of the epidemics which are so disastrous to the health of poultry in India.

Roofs should never be of thatch for several excellent reasons. They harbour rats, which breed in them and cannot be dislodged without destroying the roof. They cannot be made so close fitting that rats and other vermin cannot effect an entry. They form an ideal breeding ground for lice, ants, and termites. These last will make their earth tunnels all the way up an otherwise termite proof building in order to get at the thatch, which they will destroy in a day or two. As corrugated iron which is not shaded is inclined to get too hot you should do what you can to prevent radiation downwards from the metal roof. There are several expedients you can adopt. You can lay cement-asbestos sheets over the wire netting ceiling of the house.

PLATE IV

PLAN OF HEN HOUSE FOR 140 LAYERS.
16' SPAN & 17'-6" DEEP.

SCALE: $\frac{1}{4}$ " TO 1'



This should be well below the level of the roof and will give ample space for the circulation of air. If this is considered too expensive, the same can be done with cheap mats of split bamboo or some other inexpensive material. As these mats will certainly harbour lice they should be removed and burnt as soon as lice are noticed in them.

Next to corrugated iron I recommend cement-asbestos sheets, either flat or corrugated. The corrugated are best. Flat sheets should not be less than one-quarter inch thick and laid on light rafters spaced sixteen inches apart. There should be three rafters to the sheet. Shingles, well soaked in crude oil, overlapping planks, treated with creosote, or roofing felt can also be used. There is a variety of roofing materials, sold in rolls, which can take the place of tarred felt. These make a good tight roof if the maker's instructions are carefully carried out. This kind of roof should be tarred or painted once a year, according to the variety used.

One nest box for each four laying hens is the usual allowance but this figure need not be too strictly adhered to. If your nest boxes are made in batches of six per single tier, as suggested, four sets of six nest boxes each will be ample for one hundred laying hens. All hens do not lay at precisely the same time, nor even every day. Double and triple tier nest boxes are recommended for large houses because they are more compact and easily attended to.

Some designs for typical poultry houses are given in this chapter in order to illustrate general principles. They need not, of course, be closely copied. They should be adapted to the kind and number of fowls it is intended to keep and to the constructional materials available on the spot. Modify these designs to suit your special conditions and introduce all the improvements and simplifications you think of. Keep essential requirements constantly in mind and do not neglect these essentials for the sake of a short-sighted sense of economy. A sound house is the best investment in the long run.

It is a very good idea to make your first house considerably larger than will be required for the minimum flock you intend to commence with. Extra space is not going to do your birds any harm and you will have ample accommodation to increase your flock in the future without having to go to the expense and delay of building another house.

CHAPTER XV

APPLIANCES

IN catalogues of incubators, brooders, and other poultry appliances you will see all kinds of very nicely made and expensive articles such as mash troughs, grit hoppers, water fountains, and so forth. These are very nice but in most cases entirely unnecessary. With little help from a carpenter and tinsmith you can make equally practical, although hardly as elegant, articles for yourself. However, there are some things which it is best not to attempt. Incubators and brooders fall in this class. Although they may look simple enough they are highly complicated and scientifically contrived machines the design of which is based on years of experience and trial. Temperature, humidity, and ventilation all have to be very carefully balanced and regulated, and this is a task which is beyond the capacity of the average amateur. They are best left alone, and bought from a long established and reputable firm.

With feeding and watering apparatus the case is quite otherwise. These are very easily made by any competent amateur or village carpenter, provided a few simple principles are observed. These are:

1. They must be made of strong and durable materials which will last under exposed conditions.
2. They must be capable of easily taken to pieces for cleaning.
3. They must not harbour germs or the eggs of intestinal worms.
4. They should be so made that the birds cannot get into them and foul the food or drink with their feet or droppings.
5. They should be so designed that neither hens nor chicks can perch on them.
6. There should be sufficient of them to allow every bird to feed or drink simultaneously.

All fowls have an incurable habit of perching on every elevated object, whether this is a feeding trough or a drinking fountain. The only way to prevent this is to make all apparatus which is used for drinking or feeding impossible to perch on. This can be done by making the drinking fountains with sharply pointed tops and covering the feeding troughs with steeply sloping roofs. If the hens still persist in perching on them a strip of tin cut with a series of sharp teeth should be nailed along the ridge.

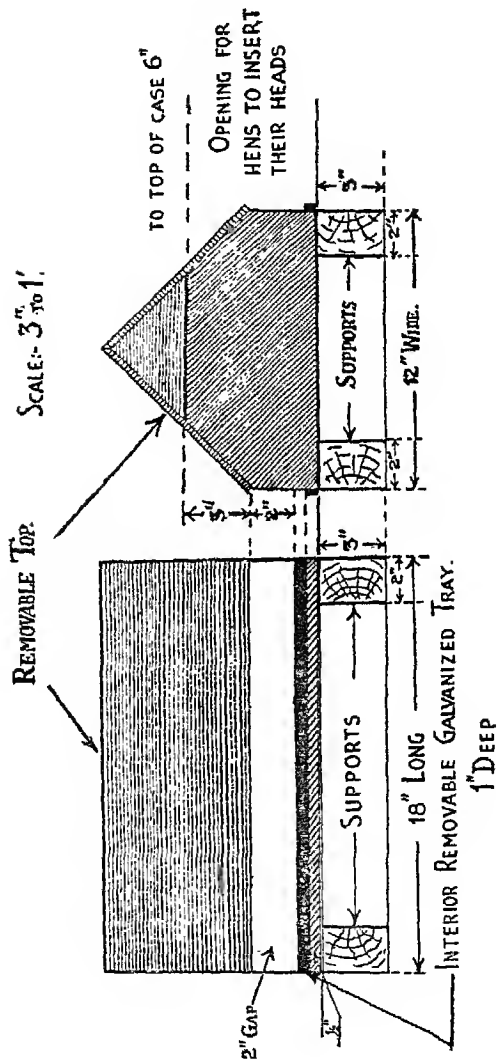
Hens do not need to take grit or lime at any stated time of day. These essentials should be available at all times and they can be placed in simple covered boxes scattered plentifully about the runs. Empty milk cases or any other small shallow boxes of about the same size will do. Hens use a large quantity of both grit and lime so the larger your boxes and the more there are of them the less frequently will they have to be filled.

Empty condensed milk cases are a handy size and these boxes are easily obtainable. They are about eighteen inches long, twelve inches wide and six inches deep. The dimensions vary somewhat according to the brand.

In order to make a rough but useful grit, lime, or mash hopper proceed as follows. But study the drawing of this article first or you may not understand the technical description. The finished trough will be just the box with low sides about two inches high and above this an opening for the hens to insert their heads into, along both sides. This is surmounted by a removable ridged roof. Along both of the longer sides mark a line four inches from the top. At each end make a mark four inches from the edge of the box. Join these marks to the ends of the lines on the sides of the box. You will then have lines at each end marking off an angle of forty-five degrees at each corner. With a sharp saw cut along these lines and keep the pieces so removed. Be careful to avoid nails with the edge of your saw.

Having done this nail a short piece along each end projecting about half an inch above the top edge. These are to keep the roof from sliding off sideways. Complete the hopper by making a roof out of the top of the case and the

HOME MADE FEEDING TROUGH MADE FROM SMALL PACKING CASE



pieces you have saved from the sides. This should project about an inch beyond the sides of the case, to keep rain out of the mash. You will then have a cheap and capacious hopper which can be used either for grit or for lime. It will have a pointed roof which will not be too comfortable to perch on. However, hens are not too particular about comfort and they may still endeavour to perch on it. If they do this, nail a strip of tin cut with sharp teeth along the top of one of the sides of the roof and bend it into a vertical position.

To protect from rot the soft wood of which this trough will be made it should be either well tarred or treated with some good brand of wood preservative, both inside and out. To keep the whole off the ground place it on a couple of bricks.

If you get a tinsmith to make you a loose tray of galvanized iron about two and one-half inches deep to fit inside this hopper it can be used for feeding wet mash. A hopper of this size will only feed about eight hens at a time. It is therefore more useful for a breeding pen than for feeding a large flock of laying hens from. If you wish to do so you must make sufficient to provide one such hopper for each eight or, at the most, ten hens. Used as grit or lime hoppers these boxes are suitable for the largest flocks. Allow one for every fifty hens and have several of them scattered about in shady corners. Keep the roofs on them to guard against contamination.

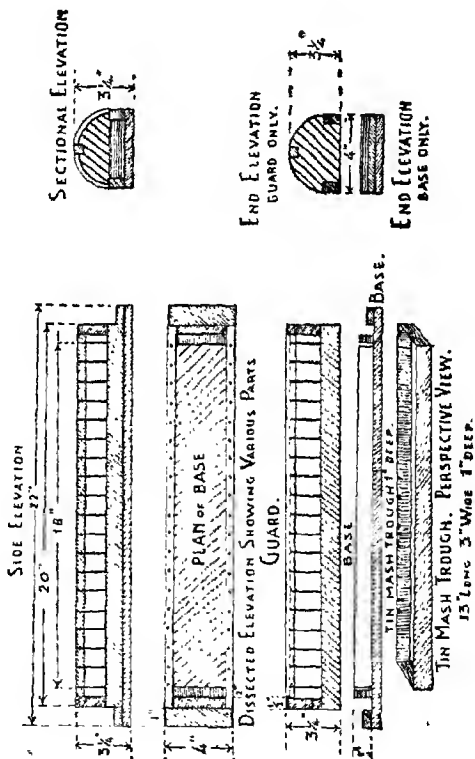
For feeding large flocks of layers a feeding more like the drawing suggested for feeding chicks should be used, increasing the dimensions to suit. The long type is the more practical.

There are drawings for two types of chick feeders. A long one for feeding 36 chicks at a time and a round one for 31. As very little wood is required to make these small feeders and the cost of timber is of minor importance they should be made of the best teak procurable. Teak is always well seasoned and shrinks and swells very little with changes of heat and moisture. It is also immune to the attacks of termites. Any apparatus carefully made of teak will last a lifetime. The drawing of the long feeder is very simple and

self-explanatory but a few words of advice are called for in making the round one which is also very simple.

PLATE VI

SMALL CHICK FEEDING TROUGH FOR 36 CHICKS SCALE: 3" TO 1".



Dimensions are rather closely calculated and should be followed carefully if it is desired to make a neat job. The

total diameter of the top disc of teak is shown as ten inches and one-quarter, for the sake of economy, but there is no

CHICK FEEDER.

10" DIAM WITH 31 OPENINGS SPACED 1" APART SCALE $\frac{1}{2}$ " TO 1" (HALF SIZE)

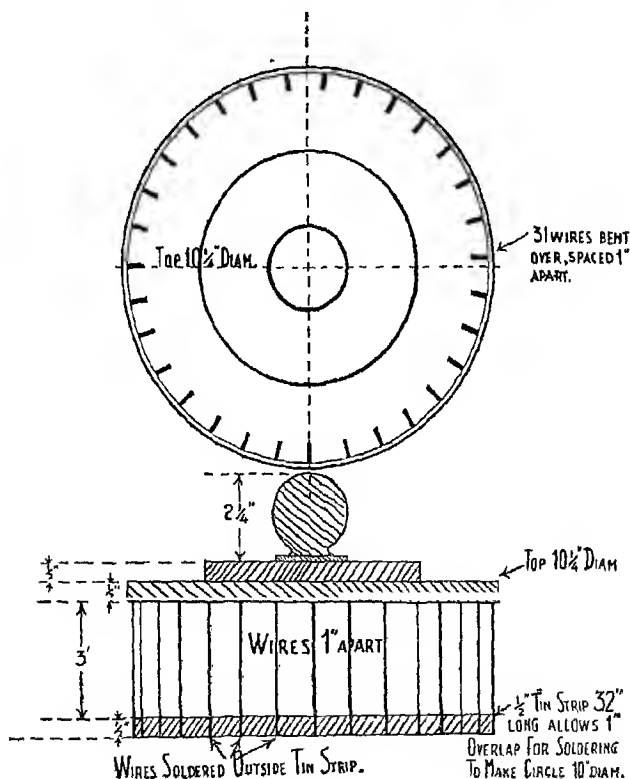


PLATE VII

reason why it should not be made eleven inches across if the timber is available. It need only be half an inch thick,

The diameter of the circle of wires is exactly ten inches. Set a pair of compasses to five inches and strike a circle. Then set the same compasses to exactly one inch and mark out 31 equal spaces round the circle. Be careful to get these exact. You may not succeed at the first attempt. These mark the places for boring the holes for the wires, which should be fairly stout, not less than one-sixteenth inch in diameter, and of galvanized iron. The strip at the bottom, which is merely placed there to keep the wires evenly spaced, is made of a narrow piece of tin plate or galvanized iron half an inch wide. This may, of course, be made of several pieces soldered together. The important thing is to make it of exactly the correct length, which is thirty-one and one-half inches. Allowing half an inch for soldering the overlap, the strip before soldering should be thirty-two inches long. You can try it by putting it over the circle you have already scribed on the circular teak disc which is to form the top; the two circles must be exactly the same size. Now all you have to do is to pass the wires through the holes, making each wire three and one-half inches long with half an inch turns over at the top to prevent them from falling out when you lift the whole thing, and solder the lower ends evenly to the tin strip at the bottom, spacing each wire one inch from the next. The turned knob at the top is not essential. It can be replaced by a drawer handle or anything convenient. A larger feeder of the same type can be made for feeding full grown hens. It is very compact and easy to make. The inside vessel should be an enamelled *thali* or similar shallow dish, nine inches in diameter. To make an annular space and keep the feed well within reach of the chicks an empty condensed milk or cigarette tin should be placed in the centre of the inner feeding vessel.

Drinking water fountains are even more easily made, and they are even more important than proper mash feeders. Improperly constructed drinking troughs are very favourite places for hens and little chicks to get their dirty feet into. Water contaminated by the filth off the feet of fowls and chicks is one of the most prolific sources for the spread of disease and even of minor ailments of every kind. So every precaution should be taken to prevent hens from getting their

feet into their water supply. Fortunately this is easily done and an excellent and efficient water fountain can be very simply improvised out of material available in any bazaar. All you have to do is to buy some enamelledir on *thalis*—the trays that Hindus eat their food off, and some round tall

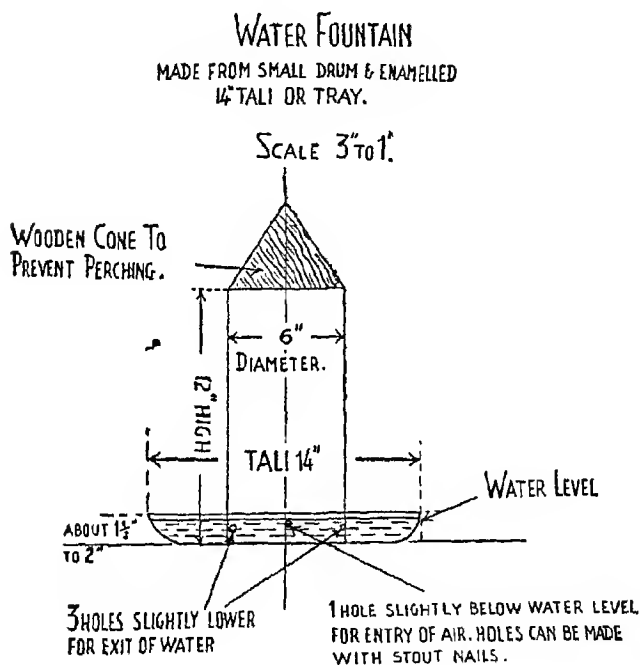


PLATE VIII

tins of various sizes. If these are not procurable in the requisite sizes, any tinsmith will make them for you.

Near the edge of the open end of the round tin, punch four holes with a large nail. Three of these holes may be quite near the edge but one must be slightly less distant from the edge than the depth of your *thali*. If the *thali* is,

say, one and one-half inches deep this hole should be about one and one-quarter inches from the extreme edge of your tin. This is all that is required in order to make a perfectly efficient water fountain, so there is no excuse for allowing your hens and young chicks to contaminate their drinking water. The tin is filled with water, the *thali* inverted over the open mouth of the tin and the whole simple contraption quickly turned upside down. The water will now flow into the *thali* until it reaches the level of the uppermost hole. The water itself will cut off the entry of air to the upper part of the tin and no more water will flow out into the trough until the hens have drunk some of the water and lowered its level below the top edge of the uppermost hole. A bubble of air will now enter this hole and sufficient water will flow into the trough to keep it filled to the previously determined level. This action will continue until the tin is completely emptied when it will have to be refilled. The larger therefore that you make your tin the less often you will have to refill it. The limit of size is the largest tin and *thali* which you can conveniently handle. Don't make it so large that you spill most of the water in turning it over.

For fully grown hens the *thali*, or other vessel, should be about eight inches larger in diameter than the tin which stands in it. Say you have a tall tin six inches in diameter and about one foot high, you will require a *thali* fourteen inches in diameter and about one and one-half to two inches deep. These dimensions are not critical, they are only mentioned as a guide. With a fourteen inch *thali* you could quite easily use a tin seven inches in diameter. This would merely reduce the clear space available for the hens to drink from, all round the fountain, from four inches to three and one-half inches, a difference which is immaterial. For newly hatched chicks a much smaller *thali* or enamelled saucer can be used and an empty "Quaker Oats" tin makes an excellent water holder. In this case a space of only two inches clear is required all round or the chicks will get into the water. As the diameter of a "Quaker Oats" tin is exactly three and one-half inches, a *thali* eight inches in diameter (a common size) would do, although according to the above directions it is just half an inch too wide. With this size

of *thali* you could also use a larger and more capacious tin, four inches in diameter. Within reason, the larger the better.

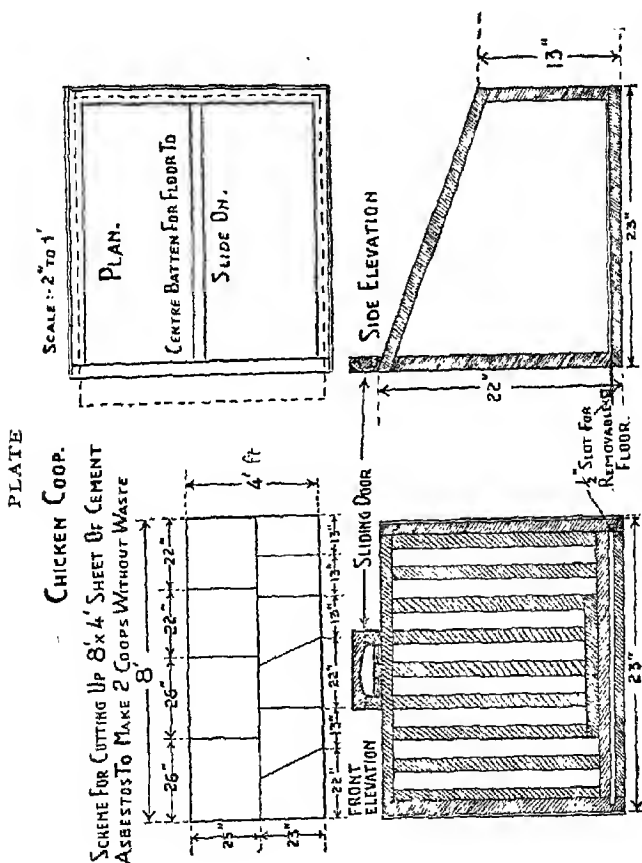
You should allow one such water fountain for each twenty-five birds, because in the hot climate of India hens need a great deal of water. As they are so cheap and easy to make you have no excuse for not having a sufficient number of them. For young chicks make the same allowance—one water fountain to every twenty-five chicks. The tins out of which you make these pieces of apparatus should be long in comparison to their diameter. Squat tins will not do as they do not hold sufficient water. "Quaker Oats" tins are too tall for newly hatched chicks to climb onto, but as they grow older they may be able to do so. If you find them perching on the tops of their drinking fountains place a sharply pointed cone on the top of each. This can be made of clay, wood, or any convenient material.

Circular feeding troughs for very young chicks are even easier to improvise. All you need is a shallow saucer or *thali* into the middle of which you have placed and inverted glass tumbler or empty tin filled with sand. The feed is placed in the annular space between the tin or tumbler and the edge of the saucer. Very young chicks are too feeble to climb onto high objects until they can use their wings. When they become more agile one of the wire screened feeders must be used, but for the first week or so this is not necessary. The best kind of tumbler is the heavy glass one of local Indian manufacture, used in tea houses and restaurants. These are too heavy to be upset by young chicks. For grit and lime intended for young chicks, empty herring or sardine tins make excellent containers, especially if they are first enamelled. A few nail holes should be punched in their bottoms for drainage and some circular object placed in them to prevent the chicks getting their feet onto their contents.

If it is carefully cut up and dimensions chosen to suit, two coops for a hen and her chicks can be made from one 8 ft. by 4 ft. cement-asbestos sheet. In the drawing of this coop a diagram is given showing how to cut up the cement-asbestos sheet in such a manner that you will obtain all the parts

necessary for two coops from one sheet without wasting a single square inch of material. The diagram should be carefully followed and, I suggest, that you make a paper or cardboard model before endeavouring to construct the full sized article.

You will remember that you cannot nail cement-asbestos sheets together without wooden strengthening pieces, so the



first thing to do after cutting out all the necessary parts is to nail a frame round each of the side pieces for one coop. Be careful to cut the slots for the front and back battens and for the removable floor, which slides in slots in the two front side uprights. In the bottom front and back pieces you will also have to cut the slots which take the batten which supports the sliding floor in the middle. You can then nail on the front and back pieces and the centre floor batten and attach the back. The front bars are one inch wide and spaced one and one-half inches apart. Note that the middle three bars are made to slide up through a slot cut in the roofing piece. The middle bar of these is housed in a V-shaped slot in the front batten, to keep it firmly in alignment. The roof is kept in place by two narrow battens cut to fit snugly between the top battens of the sides and can be easily removed in one piece for getting at the interior, without undoing any fastenings.

To finish off these coops each should be supplied with a removable run the same width as the coop and about five or six feet long. These are made with sides of eight-inch plank and a wire netting top of half inch mesh. This netting is bent over the sides and fastened with a light batten nailed over the wire.

By following this system of designing your apparatus to suit the dimensions of your material you will be able to make all kinds of poultry appliances with the minimum of workmanship and material and without any waste worth mentioning. Remember that it is false economy to make anything of cheap and indifferent material. Real economy lies in buying the best and making the most of it by good design and the irreducible minimum of first class workmanship.

It remains to say a few words about nest boxes. There are designs in this book for single, double, and triple storied boxes, with diagrams for cutting the material for each. The designs vary slightly in order that you may choose the one you like best. For instance, you may like the door arrangement shown for triple storied boxes more than that shown for double storied ones. There is nothing to prevent you from making this change, but you must be careful to alter

the cutting diagram to suit your new requirements.

It causes less work if all nest boxes are fitted to one side of the laying house. Thus you would not have to visit both sides in order to collect your daily quota of eggs. However, this is a matter of opinion; if you prefer to have nest boxes on both sides you can easily arrange this.

Nest boxes for the larger houses are all made in sets measuring exactly eight feet long—six nest boxes, each sixteen inches square, to the length of eight feet. The space between the main uprights of all houses is exactly eight feet to fit the sets of nest boxes. You will see therefore that the space available for fitting nest boxes is limited. Hence the designs for nest boxes in sets of more than one story. This is merely to enable you to fix the necessary number of boxes either to one side of your laying house or to both, as you consider most convenient. Actually all houses are shown with nest boxes fitted to both sides, but this is not essential, it is merely done to show that this can be done if necessary.

All drawings are self-explanatory so very little description is necessary. All nest boxes are built on the same principles. They are constructed on a foundation consisting of two eight-inch by one-inch planks to which all the other parts are attached. For the greatest strength slots are cut wherever possible and all component parts are let in flush. It is very important that all parts should fit tightly into the slots cut for them. Friction adds very greatly to the strength. If parts are a sloppy fit, half the strength will be sacrificed. Nails are a very poor substitute for well fitting joints.

The usual allowance for laying hens is four birds to the box, but this is only a rough rule and a good deal of latitude is permissible. Hens like to lay in dark places. For this reason one-half of the front of each nest box is screened to give a dark space inside. This is very necessary and should not be omitted. It is best to make, as far as possible, all partitions to nest boxes removable. This is quite easy in single tier boxes but not so easy in multiple storied ones. For this reason the screens fitted for darkening should

be removable. You will then be able to get at the whole of the interior for cleaning and spraying.

It will be noticed that all nest boxes are removable without pulling out any nails or undoing fastenings of any kind. This is a great convenience when the boxes have to be examined or disinfected and they should on no account be fixed permanently in place. If considered necessary turn buttons should be used.

PLATE X

SCHEME FOR CUTTING UP 3 SHEETS CEMENT ASBESTOS 8'x4' TO MAKE 2 SETS OF DOUBLE
NEST BOXES WITH 12 NESTS IN EACH SET.

SCALE :- 1" TO 1'

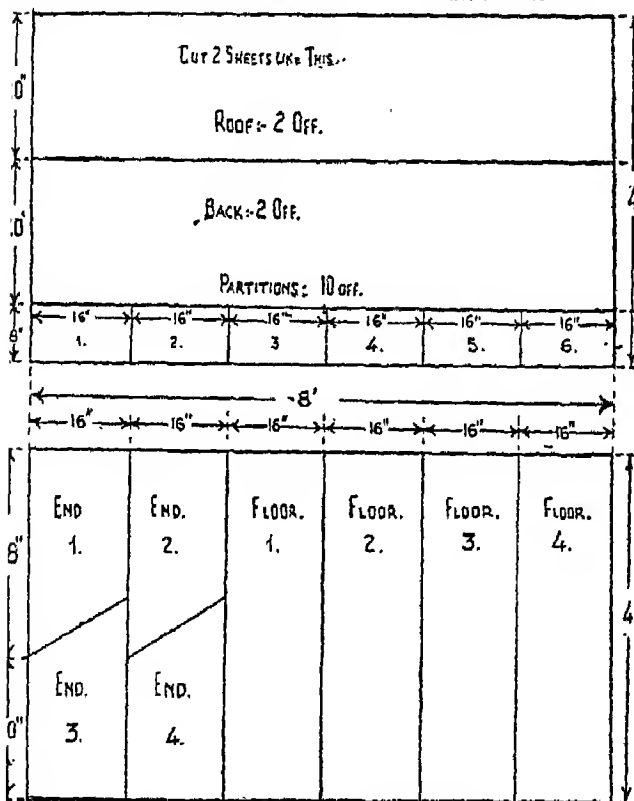
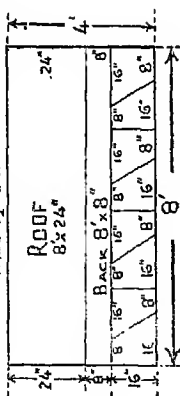


PLATE XI

SCHEME FOR CUTTING 4'x8' CEMENT ASBESTOS SHEET WITHOUT WASTE.

SCALE: $\frac{1}{2}$ " TO 1'.



RANGE OF 6 NEST BOXES EACH 16" SQUARE

FRONT ELEVATION.

SCALE: $\frac{3}{4}$ " TO 1'.

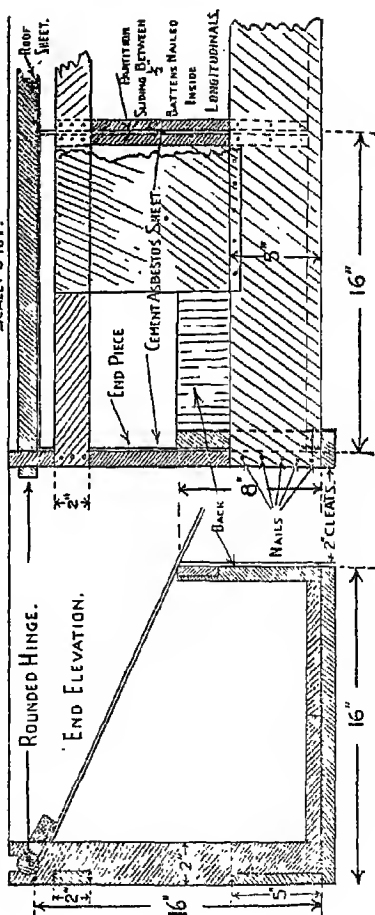
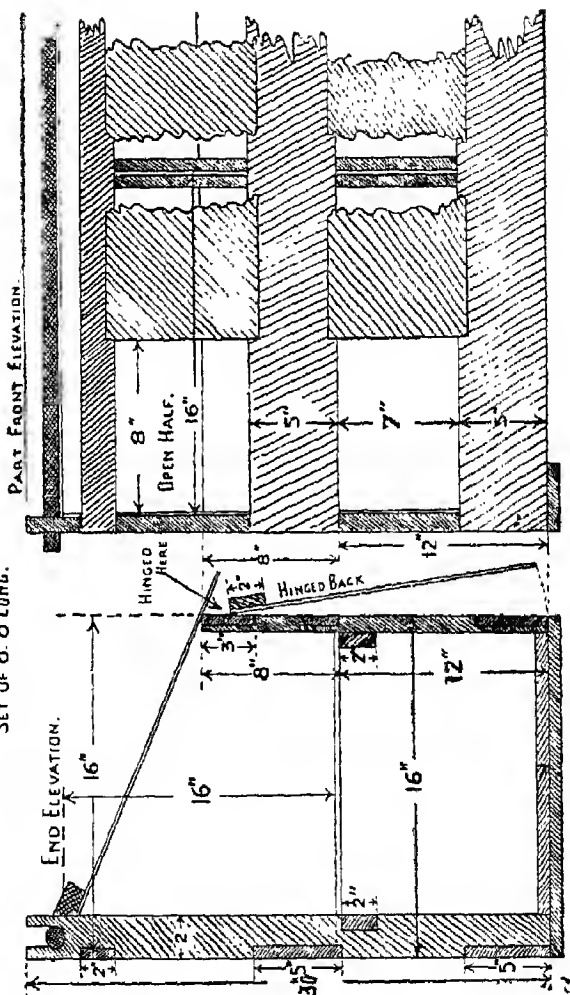


PLATE XII

PLANS FOR 2 STORIED NEST BOXES
SET OF 6. 8' LONG.

SCALE: 3" TO 1'



CHAPTER XVI

THE EXTERMINATION OF RATS

TO the poultry keeper, and everyone else for that matter, rats are an unmitigated and pestilential nuisance. Pestilential is the right word because besides destroying food, killing young chicks, and gnawing everything, they spread disease. It is well-known that rats are the carriers of plague and murine typhus besides several other less disastrous maladies, and I very strongly suspect that they are the cause of very many of those epidemics which carry off whole flocks of fowl, in a most mysterious manner, in spite of every precaution on the part of the unfortunate poultry keeper. Therefore the sooner the rat population of a poultry farm is exterminated, and kept exterminated, the better. Fortunately, this is easier than it may sound to some people who have found themselves helpless to combat the depredations of this infernal rodent. The rat is not half so intelligent as some people seem to think and his obnoxious habits can be taken advantage of to his discomfort, if not absolute destruction and extermination. This has been done before and you can do it too.

First, we will debunk some of the superstitions about rats and their marvellous intelligence, in order that the enthusiastic exterminator may not be deterred from having a determined smack at them. In the first place, it has been conclusively proved that rats will enter or feed from traps which have been handled by human beings with bare hands. You can easily prove this for yourself by setting a break-back trap, nicely baited with a piece of cheese or dried fish and very delicately set, so as to go off at the least touch, with your bare hands. You will catch your first rat without any trouble. I have even caught two rats during the same night with the same trap. However, this does not always work, because a rat can smell the blood of his own kind or even the smell of death and will avoid a trap smelling of either.

He becomes trap-shy by scent; he also becomes trap-shy by seeing his wife being caught in the trap. However, the rat's acute sense of smell can very easily be circumvented to his disadvantage. It is only necessary to make a good blaze of paper or straw and pass the trap through the flames several times. This effectively destroys the scent and makes the trap useful again as far as scent goes. Unfortunately it does not destroy the rat's memory and he may still be trap-shy through remembering the unfortunate demise of his friends and family. So, trapping is no good for extermination purposes, although it has its uses. Fortunately, there are other and far effective methods.

Just to show what can be done with traps, of the break-back type, I will give some particulars. If a very large number of traps are set, approximating to the estimated number of rats suspected to be present, a very tedious and expensive business, the rat population can be reduced to about one-third of its total. After this the rats become so trap-shy that only enough are caught to keep the rat population at this figure, the number caught in traps being made up by breeding. Rats breed with astonishing rapidity. This is, of course, not good enough. The aim is to reduce the rat population to about ten per cent. of its maximum at one fell swoop, as you might say, and then repeat the process until the rats are all but exterminated. Where the trap has its uses is when there is a particularly annoying rat, gnawing everything and doing an enormous amount of damage. A trap, carefully set, will almost always catch him. Especially if it is left for a few nights baited but unset, just to gain the rat's confidence. If a rat or rats, are gnawing everything in the room, clothes, curtains, and bedding, a few pieces of soft paper left about on the floor at night will protect the rest of the cloth in the room, because rats prefer soft paper for making nests to cloth, which is troublesome to chew up into small pieces. However, paper won't prevent rats from killing young chicks, for which they have a great liking, and will make a bee line for in preference to any other food, taking any amount of trouble to get at them.

Rats have an average litter of eight, after a gestation period of 22 days, only one day longer than chicks take to hatch

from eggs. They remain in the nest for three weeks only, although they are born blind and helpless. After from three to four months they are mature and ready to breed in their turn. So it will be seen that a few rats on the premises can very soon build up a formidable population unless drastic steps are taken to exterminate them. Reducing their numbers will do very little good.

In order to get the better of rats, or any other animals, you must have a fair working knowledge of their habits and weaknesses, which, of course, you will very unkindly take advantage of. Now, the rat is a very shy and conservative animal and on this account has earned a reputation for sagacity which he does not deserve. For instance he will avoid anything new, which he does not understand, whether it is perfectly harmless or not. If you place bait receptacles, without any poison in them, near the runs of rats, they will avoid them for several days thereby depriving themselves of a nourishing and harmless free feed. Some people who, not fully understanding the habits of rats, place tins or trays of poisoned bait near their known runs, and notice that the rats refuse these baits, come to the erroneous conclusion that the rats know that they contain poison and are dangerous. This is not the case. They are merely avoided because they are unfamiliar, which is not intelligence at all but mere unthinking conservatism.

If rats do take a feed from newly placed poison baits, they nearly always eat only a very small quantity, not enough to kill them but sufficient to give them a severe bellyache, which puts them off that particular poison, and perhaps anything placed in tins near their runs, for life. This is why putting out poisoned baits without first training the rats and gaining their confidence is no use. Just like putting out baited but unset traps until the rats get used to them, a little education must first be undertaken before poison can be made really effective.

Rats usually live and breed in one place and feed in another. Most rats are burrowing animals and therefore breed in places where they can dig convenient burrows. Between these burrows and their feeding places, which in this case

will be your store of grain, there will be found regular and well marked runs which the rats use every night. These are the places near which to place the tins of bait. Any shallow tins will do, herring, sardine, or cheese. Having carefully examined the neighbourhood and found out the breeding places of the rats and the runs by which they get to your grain stores and young chickens, you should place plenty of tins of unpoisoned bait near these runs. This bait may be bread and milk, soaked wheat (very good), biscuit meal (best), boiled rice, any coarse meal mixed with a little ghee or butter, and so forth, whatever is available. At first, for several days, these tins of bait will probably be avoided or only a very little eaten. However, you will persevere, until a good hearty meal has been taken and a very pleasant time had by all (the rats). If they have finished all the food in the tin, the next night more should be put into it, until there is some left every night. You will know then that there has been plenty for every rat and that none has gone away empty. This being a hospitable soil for a time, is just what you want!

When you are quite certain that every rat is looking forward to a good hearty meal at your expense every night, and now has the fullest confidence in your continued hospitality and good faith, you will mix poison with the bait in the tins, with the full assurance that every rat will take a full meal undeterred by any qualms or diffidence and will thereby undoubtedly imbibe a fully lethal dose of poison the very first time. There will be no question of his avoiding poisoned baits in future because he will be in a place where there are no poisoned baits to avoid. This procedure has been adopted for ridding stores of food infested with rats and it has been shown that from 85% to even 100% of rats are disposed of at the first attempt. The rats must be then given a short rest, but not long enough to allow them to breed again. Remember that the gestation period of rats is 22 days. The process is then repeated. By periodic campaigns of this kind rats can be definitely kept under. However, the procedure must be carefully and conscientiously carried out in a systematic manner.

POISONS TO USE: Some of these are equally dangerous

to human beings and rats, so must be used with great caution. Dogs, cats, fowls and other domestic animals are not so bait-shy as rats and may very easily take a full lethal dose the very first time. Barium carbonate is the safest poison to use because, for some reason or another, it is only lethal to rats; if fowls, cats, or dogs are foolish enough to eat it they come to no harm. However, if it is used for rats, tins of water must be placed where the rats can drink after they have eaten the poison. Apparently it gives them a great thirst and after they have eaten the barium carbonate they drink and die.

BARIUM CARBONATE: Harmless to human beings and animals, but lethal to rats.

ZINC PHOSPHIDE: Dangerous to man and beast.

ARSENIOUS OXIDE: White arsenic, dangerous to man and beast.

RED SQUILL: Dangerous to man and beast.

As arsenic is used by some undesirable persons for accelerating the departure of their friends and relations, it may be difficult to obtain. And nobody can blame the authorities for being careful about it. However, as it is not desirable to use the same poison twice running, that is, on the same batch of rats, two different poisons must be used. Barium carbonate should be one and a choice should be made of another from the others.

It must be remembered that all these poisons, except perhaps barium carbonate, must be used with the greatest caution and tins of bait only placed where children, domestic animals, and fowls cannot get at them. During the day they should be taken down and kept locked up in cupboards if they are to be used again, or promptly burned if they are not. No precautions are too great to take when using these dangerous poisons.

CHAPTER XVII

DUCKS

I CONSIDER that the enthusiastic amateur will do well to commence by keeping ducks instead of hens, for several very good reasons. Here they are:

1. Ducks go on laying for four or five years instead of only two as hens do.
2. They are not nearly so liable to disease.
3. Large numbers of ducks can be kept in a very much more restricted space than an equal number of hens.
4. They do not require high fences to keep them from straying. A fence three feet high is quite high enough.
5. Ducklings are much more hardy than chicks, and, in India, require no artificial heat after they are hatched.

Contrary to general belief, an expanse of water is not at all necessary for keeping laying ducks, although it has its advantages. Ducks with access to water keep themselves clean and find a good deal of their own food. If you intend to breed ducks then you must have a reasonable piece of water for them to swim on, because ducks couple on water and unless they can do this they cannot produce fertile eggs. There is one exception to this. Muscovy Ducks do not need water for coupling purposes and they can be kept in any backyard. Besides this Muscovy Ducks are very ornamental and quiet, they have no loud quack, and are therefore perhaps the best kind of duck to keep in a backyard. Their flesh is also supposed to be the best, for eating purposes, of all ducks and their eggs are very large and have no fishy taste. They are also not inclined to stray far from their permanent home although they can fly strongly. Their flights are usually confined to the immediate neighbourhood of the yard. Muscovy Ducks also, unlike other ducks, are good mothers and can be relied upon to hatch and look after their duckling properly. For backyard or small scale duck keep-

ing I strongly recommend Muscovy Ducks. I have myself kept them with great success and very little trouble.

WHAT KINDS TO KEEP: In India, as far as I am aware, the usual English fattening breeds are not available and the Indian poultry keeper must content himself with what breeds can be obtained locally unless he wishes to make the experiment of importing his breeding stock, in which case, Aylesbury Ducks are the only ones to consider. The Aylesbury Duck is a pure white breed which matures and fattens with astonishing rapidity. Within nine weeks they will have reached a weight of five pounds and will be ready for the table. The best way to start a flock of Aylesbury Ducks in India would be to import sufficient setting eggs to fill an incubator and hatch them artificially. A certain number would then be selected for breeding purposes and the rest fattened for the table. Breeding and fattening are both dealt with in future sections. If Peking Ducks are available, a Peking Drake bred to Aylesbury Ducks makes a very good and hardy cross for fattening purposes, although pure Peking Ducks are not so good for the table as Aylesburys.

Indian Runner Ducks are the most famous breed for egg production, some flocks in England averaging three hundred eggs per annum. However, Indian Runners are light birds and not so good for the table as other breeds which have been developed especially for fattening purposes. A mature Indian Runner only weighs from three and one-half to four pounds. As their name implies Indian Runners are very active and liable to stray so they should be kept in pens and not allowed free range unless the whole area is carefully fenced in. If allowed full liberty they are liable to stray for miles and so will get stolen.

The ordinary country duck is a domesticated wild duck or Mallard and although not particularly distinguished either for its rapid maturing and fattening properties or for its heavy egg-production, is none the less a very hardy and useful bird and is kept on a large scale by Chinese duck farmers, who know their business and would certainly not keep an unprofitable breed. Their great advantage is that they are procurable anywhere.

The Muscovy Duck is not a very heavy egg-producer nor does it mature with special rapidity but it has several very good points. It is procurable in most parts of India, is quiet, a good mother, makes excellent eating, and lays a fair number of very large eggs of excellent quality. As it does not require water for breeding purposes it can be kept and bred anywhere. It is also very hardy and free from disease. Altogether an excellent bird to keep on a small scale.

BREEDING: In order to breed ducks successfully they must have plenty of space and access to green food and water and a small pond or stream. If a pond is available the whole pond and a reasonable area of land should be enclosed by a low fence, about three feet high, and the breeding birds allowed free range within this area. The land should preferably be covered with grass and should slope gradually up to the duck house. The house need not be very elaborate or very high and no perches will be necessary as ducks sleep on the ground. However, the floor must be kept clean and dry and plenty of nest boxes should be available. These need not be covered as for hens and can be lined with clean straw as ducks do not breed lice so quickly as hens do. This straw will keep the eggs clean and can be burnt and renewed as soon as it becomes dirty. Ducks are inclined to lay anywhere, even on the water, so they should be fenced off from the water into a smallish pen and confined within it until about eleven in the morning when all laying will be over for the day. They can then be allowed their liberty over the whole fenced area. Ducks as well as hens require a great deal of green food and if this is not available naturally it must be supplied in the same form as for fowls. As ducks very soon foul the ground on which they run, this should be used for growing vegetables or other crops on and the ducks continually moved to fresh ground round the same pond or along the banks of the stream on which their house is situated. Although ducks will thrive on ground which would cause the death of fowls from disease within a very few months they should not be kept on the same ground too long. Another very important thing to remember is that you cannot keep both fowls and ducks on the same land. The fowls will very soon all die of disease although the ducks may thrive.

A drake cannot run with as many females as a cock and the usual allowance is three ducks to one drake. Ten ducks and three drakes make up a suitable breeding pen. Ducks kept for breeding purposes must be given as much exercise as possible, preferably on water, and a good area to forage over. The best way to arrange breeding pens is to have small portable houses each large enough to hold ten ducks and three drakes with narrow runs to the water's edge, where they will communicate with the main run which encloses the pond. After eleven in the morning, during the laying season, they may be allowed out into the main range, but until all laying is over for the day, each flock should be confined to its own pen. At the end of the day they will find their way back to their own individual quarters. The portable houses and low fences can be moved as the ground becomes foul with droppings.

As laying ducks need no access to water and as ducks, unlike fowls, do not suffer so much from disease from being kept on fouled ground they can be kept in a much smaller space than a similar number of fowls. This does not mean that they can be kept indefinitely on the same plot of land without the need for sweetening it occasionally. The wise owner of a duck farm will so arrange his pens that the land which has been occupied for some time by his laying ducks, or any other ducks for that matter, is dug up and used for the growing of vegetables or green stuff for his farm animals. In laying out a duck farm this idea should be kept in mind and the benefit of duck manure utilized to the full. As ducks do not need high fences, these may be only three feet high and of temporary nature. Choose a fairly level piece of ground which gives ample space for changing the duck's range and fence off about one quarter of it with one-inch wire netting supported on stout poles about four feet long which are forced about one foot into the ground. When the ducks have been running on this area for about six months, fence off another area with the same netting and poles, shift your portable duck house into it, and dig up the formerly occupied part and plant it with vegetables, keeping up a continual rotation in this way. You will thus make full use of the duck's manure and also keep your land fresh and

free from offensive odours and disease germs. If this is not done the land on which ducks are kept soon becomes unbearably offensive, and a nuisance to the neighbourhood. One roll of wire netting which is one hundred feet long or two which are each fifty feet long, will enclose an area 25 ft. by 25 ft., which is quite sufficient space on which to keep one hundred ducks, provided the land is changed at frequent intervals and that the ducks are given plenty of green food. The green food, for which a crop of groundnuts is recommended, can be grown on the ground lately vacated by the ducks. The land on which ducks are kept should be either sloping or otherwise well drained and the duck house should have a planked floor raised well off the ground in order to keep the ducks dry at night and while they are laying. If ducks are kept in a house with a perpetually damp floor they are liable to suffer cramp and other diseases.

FEEDING: Ducks are voracious feeders and if allowed plenty of range, as breeding ducks must, they will find a good deal of the food they need because they are untiring foragers. However, when they are kept in a confined space they must be amply fed, and the same principles which apply to fowls apply equally to ducks. They must have a well balanced diet with plenty of protein, or egg-producing material, and nothing which will encourage them to put on fat. Green food is just as essential for ducks as it is for any other kind of bird; if they fail to get it they will fail to lay or to keep in good health. The other essentials are plenty of grit, fresh water, and lime in some form. Ducks need only be fed twice a day, once in the morning and once in the evening. The food should consist of a good crumbly mash composed of whatever meal may be most cheaply available, mixed with plenty of animal protein, and coarse grit. The meal may be rice bran, ground oats, jowar meal, wheat offals, or any similar ground grain. If groundnut cake is available this is a good thing to add in the proportion of one-quarter groundnut cake to three-quarters of other meal. The animal protein may consist of any of the things recommended for fowls. Sliced green bone is specially recommended. In places near the sea, small fish, unsuitable for human food, may be bought cheaply and is just about as

good as anything. It can be fed either raw, chopped up small, or boiled and added to the mash. The water that the fish has been boiled in should be used for making the mash. Plenty of chopped green stuff should be added to the mash, and additional green food supplied during the day. The quantity should not be less than five ounces per bird, excluding green food. As a change, grain in the shape of paddy can be given for the evening or morning meal. In feeding ducks, both ducklings and mature birds, there is an important point to remember. Water must always be available near the trough from which the ducks are being fed. A duck will eat some mash, or grain, and then go to the water and take a drink. It will then return to the mash, eat some more and then have another drink, and so forth. If they are not able to drink as much as they need their food is liable to form a lump in their crops, from which it cannot pass to the bird's stomach and the unfortunate creature will die. This is especially true of small ducklings. If dry paddy is fed to ducks it should be placed in a trough and covered with water and not just scattered on the ground as for fowls.

FATTENING: In order to fatten quickly ducks should be kept in a dark place and prevented from taking any exercise. The best fattening food is boiled paddy mixed with whatever fatty animal protein which may be available. The best way to prepare this is to add to one part of paddy, four parts of water and cook until the paddy is quite soft. As much of this should be fed as the ducks will eat, with a good ration of green food and plenty of grit. No other diet is needed for fattening ducks. When feeding ducks the grit, which must be very coarse, may be added to the mash or boiled paddy, but an additional supply should be available at all times in the pen.

REARING DUCKLINGS: As ducklings are very much more hardy than chicks they are much easier to rear. In India, after they come from the incubator they need no further artificial heat. The Chinese breed ducks on a large scale and where there is a large Chinese colony day-old ducklings can be bought from them much more cheaply than they can be hatched by the amateur. In choosing these day-

old ducklings they should be carefully selected and the signs of a healthy and robust duckling are bright eyes, activity, and clean, smooth, and thick legs. Ducklings which have thin weak looking legs should be eliminated.

If day-old ducklings are not available the best way to hatch them is in an incubator. Ducks are very bad mothers, except Muscovy Ducks, and hens can only cover a small clutch of duck's eggs. As they need no artificial heat after they are hatched they are very easy to look after until they are big enough to shift for themselves, which they can do when they are a month old. Duck's eggs take twenty-eight days to hatch and the only precaution to be observed in hatching duck's eggs in an incubator is that they must be sprinkled with water every morning when the eggs are turned. Otherwise their management in an incubator is exactly the same as for fowl's eggs. As a duck's eggs has a very hard shell and the little duck's beak is rather unsuitable for pecking its way out, it is permissible to help ducklings out of the shell if they get in to serious difficulties.

Once they are perfectly dry, ducklings can be removed from the incubator and put into a low enclosure on short grass somewhere in the shade. All ducks, whether young or old, are intolerant of the direct heat of the sun and should be provided with plenty of shade. A mat spread on a platform of sticks is quite enough. As with day-old chicks ducklings need no food for the first day, but they must have a feed of grit before they take any solid food or they will be unable to digest what they eat and will die. The first meal should be of chopped hard-boiled eggs mixed with boiled rice and chopped onions given every three hours, or four times a day. Large bunches of lettuce or any other tender green leaves should be hung where the ducklings can reach them. Ducklings persistently try to get into their water supply and swim about in it, so care should be taken that their water is kept in a fountain into which it is impossible for them to get. After being fed on chopped hard-boiled eggs and boiled rice with green stuff for about four or five days the ducklings can have their diet changed to a mash composed of jowar meal or rice bran mixed with wheat offals and chopped protein food, mixed with sour milk. Protein

can consist of minced liver, boiled fish, or lean meat. Whatever green food may be available such as chopped onion tops, radish and turnip tops, or cabbage should form at least one-quarter of the mash. Sour milk as a form of animal protein, is just as good for young ducklings as it is for chicks and should be included in the diet when available. After they are ten days old the ducklings need only be fed three times a day.

As soon as the growing period is over the young ducks should be separated into three categories:—

1. Those which are to be kept for breeding.
2. Those which are to form the laying flock.
3. Those which are to be reserved for fattening.

As surplus drakes, not needed for breeding, are of no particular use except for the table they should be kept for fattening. You can tell a drake from a duck by the fact that drakes do not have a loud quack like ducks, they only make a kind of hoarse squeak. This is generally the only way to distinguish young drakes from young ducks.

Breeding pens consisting of ten ducks and three drakes each should now be made up and transferred to the breeding pens where they will get as much free range as possible. Laying ducks, which will require no drakes, should be transferred to pens which have no access to water, and all birds required for fattening to some rough shed where they will be in semi-darkness and free from interference or disturbing noises. Just as with fowls, breeding ducks should have as much liberty and exercise as possible, preferably on water. Laying ducks should not be fed on a fattening diet but their mash should contain plenty of egg-forming protein matter, whereas ducks for fattening should be given a diet calculated to form flesh as rapidly as possible, and be given no exercise.

Ducklings kept in the open during the day need only have a low fence, about one foot high, round them and can be kept in a large box at night, in some place where they will be safe from rats and other wild animals. The bottom of this box should be covered with a good thick layer of fresh paddy husks or dry chopped straw. Ducklings soon get to know the person who looks after them and will permit them-

selves to be handled freely without endeavouring to escape. In fact, they will follow their master, or mistress, about as if they recognized a parent. The fence surrounding the area on which they run, which should whenever possible be on short grass, must be shifted as often as possible. When the young birds are half grown they can be moved to a shed, instead of being kept in a box at night, the floor of which is covered with soft hay or straw, the usual precautions being taken against rats.

The Chinese keep young ducklings, until they are about half grown, in a kind of large tray, about six feet long, four feet wide, and eight inches deep, which is placed on a table either in the kitchen or in some easily accessible shed. The ducklings live on a good thick layer of dry fresh paddy husks which is renewed as it becomes soiled, and a good supply of grit and fresh water should be available. They do not leave this tray until they are old enough to be transferred to a shed. A light is kept burning in the place where the tray is kept and the owner generally gets up two or three times during the night to see how his ducklings are getting on. This seems to be quite a successful way of rearing ducklings.

Things to remember in rearing ducklings and ducks generally are: water should always be available near the mash trough as they will need a drink between visits to the mash; both ducklings and mature ducks should have ample protection from the direct rays of the sun during the hottest part of the day. This can be provided either by mats supported on a framework of sticks or by the natural shade of trees or bushes. Ducks require even more lime and grit than hens and the grit should be definitely coarser.

The Government of India Poultry Research Station informs me that Indian Runner Ducks can be obtained from the Mission Agricultural Institute, Allahabad.

CHAPTER XVIII

GEESE

AS geese feed largely on fresh green grass no attempt should be made to keep them in a confined space like ducks; a large expanse of grassland is essential. However, provided they can get an ample supply of grass they do not need so much artificial food as other poultry and are economical birds to keep. Except in the Hills or other particularly favoured parts of India the necessary expanses of grassland are not available and the keeping of geese is therefore restricted to these exceptional places.

Geese are long-lived birds and go on laying for fifteen or sixteen years. In a wild state they generally mate for life and when kept under artificial conditions there should not be more than three female geese to one gander, and one gander to two geese is better. Geese are extremely intelligent and affectionate birds and make excellent pets, and as they are also an ornament to any establishment they are good birds to keep for other than strictly utilitarian purposes. At night they are very wakeful and vigilant and give warning of unwelcome visitors in no uncertain manner, in most cases being better than watch-dogs. They become so attached to other geese that have been brought up with them that if they are separated they very soon pine away and die of grief. For this reason, if it is intended to kill geese for table purposes, all those which have been brought up together must be killed simultaneously. In my opinion geese are, of all domesticated poultry, the most interesting and responsive birds to keep and, provided there were sufficient grass to feed them, I would never be without at least one pair of geese.

They are generally good mothers and can be relied upon to bring up their rather numerous families successfully, although four or five goose eggs are very often hatched by a broody hen. The period of incubation is exactly thirty

days, and once they are hatched they do not need any artificial heat or brooders but they do need plenty of protection from the sun at mid-day. Special incubators are made for the hatching of these large eggs.

BREEDS TO KEEP: Of all the domesticated breeds the most desirable from all points of view is the Embden Goose. It is a large and pure white goose which matures early, fattens rapidly, and is a good egg layer. However, this breed is not available in India and setting eggs or breeding birds would have to be imported.

As far as I know, the only breed readily available in India is the Chinese Goose. This is a considerably smaller bird. It generally has grey-brown plumage with a characteristic bar of bronze on the neck and a rounded knob at the base of the beak. But these geese are sometimes also pure white. They are not such good table birds as the Embden Goose, but to offset this they are remarkably good layers. By removing the eggs as fast as they are laid it is possible to secure forty or fifty eggs if not more.

For mating purposes, just like ducks, these birds require a considerable expanse of water, as they actually couple on the water. If this necessity is not available it is hopeless to try the breeding of geese although they may be kept for purely egg-laying purposes, in which case the eggs will all be infertile.

HOUSING: Although geese do not need elaborate houses and perches are not necessary, they do require a good deal of floor space as they are large birds and sleep resting on the ground. For this purpose the floor should be well raised above the general level of the surrounding land, well rammed, and covered with a good layer of dry litter. Any dampness will lead to trouble. For a small flock of geese say ten geese and five ganders or fifteen birds in all, I recommend a house of not less than six feet from front to back and fifteen feet long. This need not be very high, six feet in front and five feet at the back being quite sufficient. A single sheet of corrugated iron will span the roof from front to back and eight sheets will cover the whole roof and make a perfectly water-tight job. The back should be boarded up and the rest covered with wire netting, with

a door in front. The floor should be raised at least six inches and be made of well-rammed earth. The back will be occupied by a row of six nest boxes each two feet six inches square and about eight inches deep, filled with soft straw or hay. These will do very well for sitting as well as laying geese. But you should remember that a sitting goose should have access to water for swim when she gets off the nest. Her wet plumage will damp her eggs and help to soften the shells in order to help the young goslings to break their way out. If no water is available the eggs should be sprinkled with luke-warm water regularly every day. This also applies to eggs hatched in an incubator.

FEEDING: If your geese have ample range over a wide expanse of grass with a stream or pond near it, they will require very little supplementary food. One feed of mash or soaked grain in the evening will be sufficient. The mash may be of jowar meal, barley meal, maize meal, or any other meal available and these meals may even be mixed. Where they are available onion, turnip, or carrot tops, cabbage or any other green food should be chopped and added to the mash, one-quarter of which should be of shaved green bone. Plenty of very coarse grit, or fine gravel, crushed sea shells, and fresh water should be available all day. Geese are large birds and will require at least four ounces of mash per meal. This mash can be alternated with soaked hard grain with the husks left on. This may be paddy, wheat, barley, or jowar. Prepare it by putting the necessary quantity, four ounces per bird, into water in the early morning and letting it soak all day. It can be fed in a trough, or troughs, covered with about two inches of water.

HATCHING: By taking the eggs away as soon as they are laid, geese can be persuaded to lay a large number of eggs. These can be hatched four or five at a time, under broody hens. When the goose herself goes broody she can be given fifteen eggs and left to hatch them in the nest box in the general house. If preferred, a similar nest box, two feet six inches square and nine inches deep, full of fine dry straw or grass can be placed in some quiet place where the mother will not be disturbed. Geese are very fierce when they are sitting and will attack anyone they do not know so

it is just as well to keep the sitting bird where children or visitors will not interfere with her. Water should always be within reach of sitting geese all day and the mother bird should be encouraged to take a swim every day. The eggs will come to no harm if they are left for a whole hour at a time. The bird should be given a good feed of soaked grain as she will not have time to eat much grass, and grit and water should be within easy reach.

REARING: Young goslings can be left unfed for twenty-four hours and kept confined in a large coop and enclosure on a space of short grass under the shade of trees or bushes. If no natural shade is available this must be improvised with mats. After the first twenty-four hours, during which grit and water should be available to the young goslings, they should be given their first meal consisting of bread or chapatties soaked in milk, the mother being given a good feed of mash or soaked grain at the same time. After this first meal they may be fed on a mash consisting of bread-crumbs, chopped hard boiled eggs (goose eggs will do), boiled rice, and chopped onion tops mixed to a crumbly consistency with any kind of meal available. This mash should be fed four times a day for the first week when it can be reduced to three times a day, the goslings being given the opportunity to eat as much fresh green grass as they need. You should remember to have an ample supply of drinking water available at the time of feeding or you may encounter the same disaster as with your ducks, from the goslings getting a choked crop due to having no water with their feed. After two weeks in a coop with enclosure, moved frequently, the goslings may be given their liberty and allowed to roam with their mother. As both geese and goslings are inclined to wander a long distance from their home and get lost, they should be looked after by a *chokra* unless the land on which they feed is enclosed in such a way that they cannot get out. After they are released they need only be fed twice a day.

FATTENING: Young birds intended for fattening should not be allowed too much liberty or be permitted to swim. After they are released from the pen they should be given two meals a day of mash alternated with soaked grain. When

they are about two months old they should be confined in pens for fattening and fed on a meal of mash in the morning and soaked grain in the evening. For fattening purposes it is best to give the more fattening meals such as maize, ground oats, or barley, but if these are not available, jowar meal can be substituted. Unfortunately, in India there is no question of feeding poultry on the best foods for various purposes but of feeding them on what is most readily and cheaply available. Although the birds may not fatten quite so readily or rapidly the final result is about the same. Geese should be fed on fattening foods as long as they take an interest in their diet, but as soon as they show any signs of going off their feed and refusing their meals they must be killed or they will rapidly lose condition.

In both, penning geese for fattening and in killing them, there is a very important point to remember. Geese are very affectionate birds and strongly attached to their relatives and companions. If any attempt is made to separate families or even birds which have been brought up together either for fattening or any other purpose they will pine away and either die or lose condition. So all birds belonging to one family, both males and females, must all be penned and fattened together. The same applies to killing, the whole family must be killed at one time or all allowed to live. If geese are purchased care must be taken to buy a pair which have lived together and not single birds, or they will not thrive.

Geese are not bred at the Government of India Research Stations, and so cannot be purchased except from local poultry fanciers or in the markets.

CHAPTER XIX

TURKEYS

WITH, perhaps, the exception of guinea fowls the turkey is the most recently domesticated of all birds and retains to a large extent its wild habits and characteristics. Turkeys require an exceptionally wide free range and preferably on land which is covered with trees and bushes and therefore provides a large amount of natural food, which the turkeys are very clever at finding for themselves. To endeavour to keep them in a confined space or under conditions which are favourable for fowls or ducks is to ensure disaster. A fairly extensive run in which hens would find all the freedom they need would be quite inadequate for a flock of turkeys.

As turkeys prefer a dry climate India suits them well provided they can find shelter in the shade during the hot part of the day. A loose gravelly or laterite soil is best but it must support sufficient vegetation to provide the insect food and seeds that turkeys chiefly live on; a dry barren soil is unsuitable and so is a heavy sodden clay on which turkeys will not thrive. The best location for turkeys is some place where there is plenty of low scrubby jungle interspersed with patches of grass—the kind of jungle inhabited by jungle fowl. Turkeys will forage all day in jungle of this type and return in the evening with their crops full of insects and grass or other seeds and wild fruit. Under these conditions they only need one feed just before they go to roost.

BREEDS TO KEEP: Government of India Research Stations do not breed turkeys as yet so the prospective breeder will have to depend on his own resources when buying his breeding flock. The only thing to do under the circumstances is to buy the best birds procurable locally or import them from either England or Australia.

American Bronze Turkeys are the largest domestic breed and if the object is to breed the largest possible birds this

breed should be adopted. The males weigh, when full grown, from twenty-five to over thirty pounds and are very handsome birds. The hens weigh from fourteen to sixteen pounds. The Cambridge Bronze and the Norfolk Black are other useful European varieties of somewhat smaller size, and the white variety which I have seen both in India and Persia is not to be despised. However, there is one point to remember in breeding turkeys, they should not be inbred or they soon lose their stamina. Fresh cock birds should be obtained from some outside source to breed from in the second generation.

HOUSING: Turkeys have to be housed in sheds which suit their peculiar habits and not less than fifteen square feet of floor space should be allowed per bird. When the doors of a turkey house are opened in the morning, the birds fly direct from their perches right through the door and alight about thirty or forty feet away from the house. If the door is too small they will hit it with their wings and injure themselves. It is best therefore to have large double doors, each about four feet wide, in the front of the house which can be thrown open simultaneously. The best ratio is about six hens to one cock so a house for a single pen of seven turkeys should have at least one hundred square feet. This would make a house of about ten feet by ten feet and fairly high, say eight feet in front and seven feet at the back. As turkeys are hardy birds and need plenty of fresh air, only the back need be boarded and the rest, including the doors, can be covered with large mesh wire netting. Perches should be wide and strong as turkeys are large and heavy birds. Bamboos four inches in diameter will do very well and should be arranged at different levels, the lowest in the front of the house and the highest at the back. If there are to be two perches running the full width of the house the first can be three feet off the ground and the back one two feet away from this and two feet higher. Nest boxes will not be required as turkeys will not lay in confined spaces. For laying purposes, large boxes or barrels with a good layer of soft dry hay in them should be arranged about the premises in quiet corners or under bushes. If turkeys are allowed their liberty when they commence to lay they may fly for miles

and lay in places which are almost impossible to find. I lost one of my turkeys on one occasion and after about a month in spite of cats and all the dangers of the jungle she suddenly appeared from nowhere followed by a brood of a dozen perfectly healthy chicks. However, this is not a matter to be encouraged.

FEEDING: As turkeys are half-wild birds and, of course, never get mash in their wild state, I consider a diet consisting entirely of dry hard grain the best for all turkeys which are not being fattened for the table. The idea is to keep breeding turkeys hard, muscular, and fit without the least trace of fat, and hard grain feed is the best way to ensure that they do not put on too much weight. Turkeys have enormous appetites and unless they are given a very wide range on land which provides them with a considerable quantity of natural wild food they require a very large ration of grain. For this reason, if for no other, they should have ample opportunity of foraging for themselves or they will be an expensive proposition. Fortunately they are excellent foragers and given a reasonable chance will find most of their own food. I recommend one feed of hard grain, given in the evening, for all flocks of breeding turkeys and no mash at all. Grit, broken shell, and ample pure drinking water are essential as for all other poultry. If the feed is given at the same time every evening it will encourage your turkeys to assemble in your yard in time to roost at home, instead of staying in the jungle and roosting in trees as they are very fond of doing. There is no reason why, in the mild climate of India, turkeys should not roost in the open at all times of the year except during the monsoon. To facilitate their ascent to a height which will ensure safety from jackals and other roving ground vermin perches should be so arranged that the turkeys can hop from one to another until they can reach the branches of some large tree at a safe height. I need hardly say that this is not a good idea where there are jungle cats about. The general idea about feeding turkeys is that the more food they can be persuaded to find for themselves the less they will have to be supplied with. It is a good idea to feel their crops in the evenings when they return from foraging and before they have had

their last meal of hard grain. If their crops are full, as they should be, it is a sign that they are getting sufficient insect and other food; if they are not the range should be increased or a feed containing a good proportion of green bone, lean meat scraps, or other animal protein should be given in the morning. Even if their crops seem to be full the last meal of grain should not be withheld. From the above it will be seen that feeding turkeys is a fairly simple matter. Any mixed grain made up of two or three of the following is suitable: paddy, wheat, or barley, all with the husks intact, jowar, ragi or any country grains which may be available, except maize which is too fattening unless given in very small quantities mixed with other grain. Avoid "dal" of any kind or beans. It is far easier to give your birds liver complaint than to cure them of it.

HATCHING: As is the case of geese the number of eggs laid by a turkey can be increased by taking them away as they are laid and replacing them with artificial nest eggs. The eggs so removed should be hatched under a broody hen. However, this should not be overdone as the chicks resulting from the last eggs laid are not likely to be anything like so hardy as those from the first. Turkeys are liable to "lay wild," that is, to fly away and lay anywhere, so when they are about to lay the greatest pains should be taken to supply them with suitable laying places cunningly placed in secluded and partly hidden spots. You will be able to tell when the hen is going to lay by the way in which she wanders about investigating suitable locations for a nest. This is the time to supply her with a large box well lined with soft hay and hidden in a corner or under a bush. Remember that a turkey is a large bird and requires a large nest box; three feet square is not too large but a forty gallon wooden barrel makes an ideal nest. It should have a piece of board nailed across the bottom of the opening to prevent the eggs from rolling out. If this nest is in some quiet spot where the mother is likely to be undisturbed she can be left to hatch her eggs there but if it is not she can be shifted at night, although this should not be done if it can be avoided. A turkey can cover fifteen of her own eggs but as they are rather large a hen can only cover between eight to ten depending on the size of the hen.

While sitting, turkeys should be fed exclusively on hard grain and have a supply of very coarse grit and water near at hand, or beak! Grit, lime, and pure water are just as necessary for turkeys as for any other birds but turkeys being larger require more and coarser stuff. When the chicks are hatched, just as with any other young newly hatched birds, they do not require any food for the first twenty-four hours but they must get a feed of grit before they are fed and they will need drinking water, especially if the weather is very hot. The mother should be given a good feed as soon as the last chick is out of the shell and the whole family left undisturbed until next day, when they can be shifted to a coop placed on short grass or turf. Turkey chicks are very delicate until their wattles begin to acquire a red tint, which is called "shooting the red" and until then they should be carefully looked after and not allowed to stray too far. After from six weeks to two months, depending on breed and environment, the chicks will have shot the red and from then onwards will be very much hardier and able to look after themselves. The first two months is the critical period. The causes of loss during the first six weeks or so are: unsuitable diet given at too long intervals; damp and cold soils; lack of sufficient liberty. The less young turkeys are kept cooped up the better and after the first few days they should be let out of their pen for several hours per day. While they are out the opportunity should be taken of shifting the coop and pen to fresh ground. On no account should young turkeys be kept on fouled ground. After they are ten days old they can be allowed out for the whole day but they must be carefully cooped again at night.

FEEDING: Young turkey chicks are rather a nuisance to look after as they have to be fed six times a day until they are a month old when they can be reduced to three meals per day. Feeding should be at regular intervals spaced two hours apart, the first feed being in the very early morning and the last at dusk. As the young birds are fed frequently, each feed need not be too large but ample in quantity. Turkeys require a considerable amount of animal protein and this can be supplied, at first, in the form of sour

milk or "dhai," mixed with boiled rice or stale bread to a crumbly mash. Any of the diets recommended for young chicks are equally suitable for young turkeys and they should be varied as far as possible. Milk and Sussex ground oats or oatmeal, jowar meal and sour milk, and so forth. For the first week or two chopped onions or onion tops, or any fresh green leafy vegetables such as cabbage or lettuce should always be included in the diet, and this should be continued until the young birds are able to forage sufficient green stuff for themselves. After the first few days the mash meals may be alternated with feeds of any small seeds such as canary seed or ragi. If neither of these is available crushed jowar, broken rice, or crushed wheat can be substituted. In places where rice bran is available this may be used with sour milk as a mash. When the young chicks begin to shoot the red they need only have one feed of mash per day, whenever it is convenient to give it to them. This should have a liberal supply of chopped lean meat, green bone, or some other form of protein food such as fresh cooked fish. Dried and salt fish should never be given to any kind of poultry as the salt in such large doses is not good for them. When the young turkeys are three-quarters grown they should be placed on the same diet as adult birds without any mash at all. Of course, all household scraps such as cold boiled potatoes and rice, the outer leaves of vegetables, meat and fish scraps, etc., are just as useful in making up mash for turkeys as they are for hens.

FATTENING: Turkeys take about one month to fatten and during this time should be confined in a good airy shed with plenty of perches about three feet off the ground, in some quiet corner where the birds will be free from disturbance. The food should consist of a mash in the early morning made of whatever fattening meal may be available mixed with sour milk, chopped vegetables, boiled rice and potatoes, and fat when available. Turkeys have voracious appetites and will eat enough to fatten themselves without any urging. Grit and fresh water should be available all day and the evening meal should consist of soaked or boiled paddy and maize. Either of these grains contains sufficient starch to fatten rapidly but should they not be available you must

do the best you can with jowar, wheat, or barley. The same applies to mash—use what you can get most easily and cheaply: rice bran, jowar meal, ground oats, wheat offals, maize meal and so forth, but give plenty of it.

CHAPTER XX

GUINEA FOWLS

ANYONE who attempts to keep guinea fowls under anything remotely resembling intensive conditions is doomed to disappointment for of all birds kept under artificial conditions they are the least domesticated and most liable to show their complete independence and self-reliance. It is no use attempting to keep them in enclosed pens as they are strong flyers and will treat the usual high fence with supreme contempt. However, they are extremely hardy and, given any sort of chance, will keep themselves, finding all the food they need during their daily foraging which will take them very long distances from home.

Guinea fowls inhabit dry and more or less desolate regions where food is scarce and difficult to find. As they are more often than not in the pink of condition when shot in their natural home, just like jungle fowl, it is obvious that they have a very great natural aptitude for finding food where the domestic hen would starve. Provided that the prospective guinea fowl owner is the possessor of a considerable tract of land free from unwelcome trespassers he can keep these interesting and ornamental birds in a semi-wild condition. If they are regularly given a small feed of hard grain every evening it might be possible to persuade them to return each evening and roost in the trees round the house or even on the rafters of barns or outhouses. If they find plenty to eat in the surrounding country and congenial roosting places they may decide to remain away from civilisation and in this case may be very difficult to find.

Guinea fowls prefer a light gravelly or laterite soil in a hilly, though not mountainous, district where there are patches of jungle and low scrub alternating with open grassy glades. As they live largely on grass seeds, grubs, grasshoppers, and other insects, the more grass there is about the better. How-

ever, they are adaptable birds and I have seen them scratching about quite happily in the streets of Bombay city.

Unless it is intended to keep them in a semi-wild state, in which case they can be left severely alone to breed as they please, guinea fowls should not be allowed to hatch their own eggs. If they are permitted to do so they will lead their chicks away to the nearest patch of jungle and probably disappear off the face of the earth, as far as their owner is concerned. The best way to start is to obtain a setting of eggs and hatch them under a broody hen. The onus of finding and supplying the eggs will then be on the vendor.

Guinea fowls cannot be persuaded to lay in the place which is most convenient to their owner. They invariably "lay wild" and generally in some remote and well concealed spot almost impossible to find. Small boys are useful here and guided by the hoarse metallic cluck of the hen they may be able to locate her nest. They must be very circumspect and take great care not to allow the guinea hen to realize that her nest has been spotted or disturbed in any way. If she suspects any such thing she will promptly desert her nest, even with several eggs in it, and proceed to make another elsewhere which may be a long way off and even more difficult to find. When she has laid her full clutch of eggs, which will be about twelve or fifteen, they may be taken from the nest and placed under a hen. If the guinea fowl decides to lay again she should be left undisturbed to bring up her brood or she may decide to desert the district altogether.

Both cock and hen guinea fowl resemble each other very closely and from a mere inspection of their plumage it is almost impossible to distinguish the sexes. It is only the hen which utters a peculiar, penetrating, and rather irritating note and the cock can therefore be recognized by his silence. The cock also lowers his wings until they brush the ground and takes short steps like a dancer while he struts round the hen, just like a barnyard rooster. There should not be more than three hens to each cock or eggs are likely to be infertile. In the wild state they usually pair off, one male to each

female. Guinea fowls are excellent eating and require no fattening. The difficulty is to catch them when required and this can practically only be done while they are roosting. As guinea fowls require no houses and roost quite happily in trees, this is none too easy.

HATCHING AND REARING: This should always be done under a hen and when chicks are hatched they should be placed in a coop on short grass just like any other chicks, care being taken to give the hen a good feed of mash and the chicks plenty of fine grit and drinking water during the first twenty-four hours when they will need no food. These chicks should be fed every two hours, just like any other chicks, small grain being introduced into the ration after the first few days. The chicks are very hardy and self-reliant and can be let loose with the hen after three or four days, and after three weeks to a month are able to shift for themselves. At this stage they should be fed regularly in the evening and persuaded to roost in the trees surrounding the house of their owner. If there are no trees near the house they will go off and roost in any neighbouring tree, or trees, which suit their fancy, which may be a long way off and not too handy for catching the birds at night when they may be needed for the table. Anyone who has a fairly large estate might very well stock it with guinea fowl for sporting purposes. If the ground suits them they will very soon multiply and can then be driven and shot just like pheasants or jungle fowl as they are strong flyers. Or they may be shot over dogs.

CHAPTER XXI

THE PRESERVATION OF EGGS

EGGs deteriorate on account of several causes. In the hot and dry climate of India the first thing which happens is that the water contents of the eggs begin to evaporate through the shell. This leads to the formation of a space filled with air at the larger end of the egg which gets larger and larger as evaporation proceeds and the eggs get progressively staler. If a perfectly fresh egg is placed in sufficient water to completely cover it the result will be that the egg will sink to the bottom and rest in an almost horizontal position, because the empty space at the larger end of the egg is practically absent. An egg which has been kept for some days will have a much larger airspace at its larger end and will take up a position at the bottom of the vessel with its larger end inclined upwards. Finally, when the egg is very stale and the airspace very large the egg will float vertically with only its smaller end touching the bottom. An exceptionally stale egg will actually float to the surface of the water, big end upwards. I need hardly say that any egg which floats on the surface or even with only its smaller end touching the bottom is not worth buying or preserving.

Further deterioration occurs through microbes of one sort or another finding their way through the shell of the eggs and setting up putrefaction. The object of the egg-preservative is to prevent evaporation and also the entry of bacteria through the shell. All eggs destined for preservation should be given a fair start by being as fresh as possible, free from cracks and defects (which will permit the entry of bacteria), and perfectly clean. If they are put into the preserving solution when fouled with hen's excrement or any other form of dirt this will contaminate the solution and give rise very rapidly to putrefactive changes in all the eggs which it contains. It should be remembered that one dirty or damaged egg is capable of spoiling the whole batch.

Preservative methods can be divided into two classes: those intended to preserve eggs for a short time only without the use of elaborate arrangements and those intended to preserve comparatively large quantities of eggs for periods up to six months or so. They are all based on the same principles, to prevent evaporation and to preserve the eggs from the entry of bacteria through their shells. But all eggs for this purpose must be absolutely fresh to commence with. It would not be of much use trying to preserve eggs which are already bad or too stale to be worth preserving.

Experiment has shown that eggs begin to show signs of deterioration at as low a temperature as 45° F. and European books on eggs preservation recommend that they should therefore be kept at a temperature of not more than 35° F. This, of course, for most parts of India is quite impossible without refrigeration of some kind. However, experience has also proved that eggs can be preserved, for a time at least, in the climate of any part of India, although not for as long as in Europe or any other cool climate. The fact remains that all preserved eggs should be kept as cool as possible and in a place which is fresh, free from unpleasant odours, and well ventilated. A container of preserved eggs which is exposed to the sun long enough to get thoroughly heated up even for a few hours will be irretrievably spoiled. They should therefore be kept in some room, preferably underground, which is protected from the direct rays of the sun at all times of the day. To keep eggs for a short period the ideal way is to place them in a refrigerator kept at about freezing point. On removal the eggs should be used at once.

Perfectly fresh eggs should be allowed to cool before an attempt is made to preserve them in any way. The easiest method is to smear the fresh eggs all over with fresh butter, care being taken that no part is left uncovered. Eggs treated like this will keep for some weeks in a fairly cool climate and in a cool room. The best way to store them is in perforated trays, large end upwards. Infertile eggs keep better than fertile ones. If perforated trays are not available they may be kept in shallow trays filled with perfectly dry and carefully sifted coarse sand. In this case they should be turned every day and not kept too long. There is no doubt

that in the Punjab and other cool parts of India eggs can be kept with perfect confidence all through the cold weather by the method of immersion in a suitable fluid, but when smearing with butter is tried they should be tested every week by using at least one egg. If they show the least sign of deterioration they should all be used at once or they will become a dead loss. Before trying any form of egg-preservation on a large scale smaller experiments should be made with, say, a couple of dozen eggs to find out exactly how long eggs can actually be preserved in the particular district where the experiment is to be tried. It is impossible in the varied climate of India to lay down any hard and fast rules. What may be possible, and even easy, in the Punjab might be quite impracticable in Madras. Another way to preserve eggs temporarily is to dip them in glycerine and treat them in the same way as eggs smeared with butter but this method is not recommended.

For egg-preservation on a larger scale and for longer periods there are two methods available: immersion in a solution of lime or in one of water-glass (sodium silicate). Of the two, water-glass will preserve eggs for a longer period than lime-water will. But no exact time can be laid down, this must depend on local experiment and experience. Therefore large scale operations are not recommended until these experiments have been completed.

LIME-WATER: The cheapest and, probably, most practical and economical method of preserving eggs in India is in a solution of lime-water, lime being available at a very moderate price all over the country. Containers can be wooden barrels, galvanized drums, or large earthenware chat-ties. In the hottest parts of India perhaps it would be best to keep the eggs in some kind of earthenware vessel which is sufficiently porous to allow constant evaporation to take place. This would keep the contents several degrees cooler but has the very great disadvantage that the solution would have to be very frequently replaced as it evaporates and any neglect to do so would result in the level of the liquid falling below the topmost layer of eggs which would lead to the whole batch being spoilt. I have seen fairly large batches of eggs, up to five hundred in a batch, quite successfully



preserved in large glazed earthenware chatties, covered with loosely fitting wooden lids to prevent too rapid loss of solution by evaporation. But any thoroughly clean and water-tight container will do equally well.

To prepare the solution add 20 oz. of finely sifted slaked lime to every five gallons of boiled and filtered water. This boiling and filtering is very important in India where water supplies in some places may not be entirely free from algae or other micro-organisms. It is imperative that the solution should be free from any possibility of contamination from the start although once the solution has been properly made, whether it is lime or water-glass, it will remain sterile and not communicate any germs to the eggs. The lime solution should be prepared at least a week before it is needed as lime takes a very long time to dissolve and to aid this the lime should be well stirred several times a day. After three or four days one pound of coarse salt should be added to every five gallons of solution and care should be taken to make a good deal more solution than will suffice to barely cover the eggs as some will be required for making up the level as the water evaporates. When the solution is required for use the supernatant liquid should be carefully poured out, leaving the whole of the undissolved lime in the bottom of the vessel in which the solution has been prepared. Only the perfectly clear solution should be used, without a trace of undissolved lime.

All eggs having been carefully examined for imperfections and all imperfect ones rejected and dirty ones thoroughly washed, freshly laid eggs having been allowed to cool, they should be carefully arranged in layers in the bottom of the vessel in which they are to be preserved. They should not reach right up to the top as it will be necessary to cover them with at least four inches of solution in order to allow for evaporation and possible carelessness in periodical inspection. The solution should now be carefully poured over the eggs, not too hastily, until they are covered to a depth of four inches. When required for use or for sale, the eggs should be scooped out with a perforated ladle, care being taken not to break any as one broken egg will contaminate the solution and make it necessary either to change the whole

of it immediately or get rid of the eggs at once. Before sale or use the eggs should be washed and dried. The eggs should be scooped out of the lime solution rather than lifted by hand because the lime solution has a bad effect on the human skin and contact with it should be avoided as far as possible.

WATER-GLASS: Sodium silicate is sold as a heavy and sticky concentrated solution in two qualities, pure and commercial. The commercial article is much cheaper and quite good enough for egg preservation. It is rather difficult stuff to dissolve and the best way of doing this is to add boiling water in small quantities at a time, stirring thoroughly after each addition. If this is not done the very heavy sodium silicate is likely to sink to the bottom and remain there undissolved. Unlike lime, which is very sparingly soluble in water and of which a saturated solution is always used, sodium silicate is very soluble and it is quite easy to add an unnecessarily large quantity. The solution generally used is one part of water-glass to ten parts of water. But I am told that half this quantity is quite as effective. Perhaps it would be wisest to split the difference and add one part of water-glass to fifteen parts of water. The solution should be allowed to cool before use.

Eggs should be chosen and treated as for preservation in lime and the solution of water-glass poured over them in just the same way, a good reserve of solution being kept, free from dust, to make up for evaporation. As sodium silicate has no deleterious action on the skin, the hands may be used for taking the eggs out of their container. In the case of water-glass, just as for lime, all eggs taken out of the solution should be washed and dried before use. Actually, if the eggs are just dipped into a water-glass solution and left to dry without any previous washing they are said to keep quite well for a short period, but this is hardly worth trying in India where climatic conditions are so unfavourable to the prolonged preservation of eggs or any other perishable food stuff.

Although eggs are preserved in very large quantities in Europe by both the above processes and are quite good up

to a period of six months, and even longer in the case of water-glass, it should not be taken for granted that the same results can be obtained in the hotter parts of India. Before embarking on egg-preservation in bulk small scale experiments should always be made. There may be some small omission, due to lack of experience, which may lead to failure at the first attempt. Try a few dozen eggs in either of the above ways, taking a couple of eggs out every two weeks for inspection. You will very soon find out how long it is safe and profitable to keep them and you will then be able to make experiments on a larger scale. The cost will be trifling and the experience gained most valuable.

CHAPTER XXII

POULTRY DISEASES

THAT prevention is better than cure applies just as strongly to poultry as it does to human beings, more strongly perhaps because human ills are better understood than those of the domesticated birds. I think that nobody will deny that it is far better and more satisfactory to keep a flock free from disease than to be compelled to treat the birds after they have become sick. As birds cannot explain their symptoms it is more often than not impossible to tell that an epidemic has commenced until it has obtained a strong hold and not only have a large number of valuable birds died, but have already contaminated the ground so badly that the remainder of the flock will have to be moved to fresh ground at considerable expense. If this is not done immediately as likely as not the whole poultry yard will cease to exist.

Unfortunately poultry suffer from a large variety of diseases, some of which are so virulent and widespread that they are almost impossible to deal with effectively and economically. Perfect hygiene is the secret of a healthy flock and this can only be purchased at the cost of eternal vigilance. Servants in the East are notoriously careless and inefficient and they can only be persuaded to do their work thoroughly by constant personal supervision. They cannot grasp the need for keeping mere birds in a state of scrupulous cleanliness, which they look upon as ridiculous and unnecessary fastidiousness.

HOUSING AND VENTILATION: Attention has already been drawn to the necessity of having well ventilated and airy houses in the hot and oppressive climate of many parts of India. If hen houses are built on the principles laid down in the chapter on housing there will be no lack of fresh air and ample ventilation. Having built a well designed and hygienic house it is not sufficient to just sit down and admire it. Cleanliness is just as important as good quarters. By

allowing droppings to accumulate and neglecting to disinfect the houses at frequent intervals all benefit of good design will be wasted. Nothing is so conducive to poultry disease as filthy surroundings whether of house or run. Valuable imported birds of high egg-laying strains should never be let loose on land which has already been contaminated by country fowls of uncertain antecedents. All houses should be cleaned out at frequent intervals, not less than twice a week and preferably daily. Droppings are a very rich and valuable manure both for the flower and vegetable garden. If the droppings are dried in the sun, then pulverized and mixed with ten times their weight of fine earth mixed with wood ashes, this mixture will contribute greatly to the fertility of otherwise useless land. In this way hygiene can be combined with economy. Droppings should on no account be wasted or allowed to accumulate.

EXERCISE: The very great importance to the health of poultry of sufficient exercise has already been emphasized. No birds can exist in perfect health unless they are given as much exercise as they get in their wild state. Exercise keeps the organs of fowls toned up and resistant to disease. If birds tend to get fat and lethargic not only should their ration be decreased but their exercise should be greatly increased. It is much more difficult to get rid of fat than to prevent it from forming.

CORRECT DIET: Fowls which are expected to lay a large number of eggs must be fed a correct diet and kept in hard condition. The most important item in their diet is a sufficiency of protein food either in the form of fresh worms and insects or fresh lean meat and green bone, for without this important item of food your hens will neither lay nor keep in sound health. Grit, lime, and pure water are equally necessary. To keep fowls in good health and also to supply them with the minerals and vitamins necessary for perfect condition and freedom from deficiency diseases a regular supply of fresh green food is essential—stunted tufts of dry grass are no substitute for the fresh green article.

If sufficient attention is given to housing, environment, and a correct diet combined with plenty of exercise and the flock

is started off free from disease the fortunate poultry keeper should be practically insured against serious disease, but if any of these precautions are neglected he is in for a bad time ending in serious loss.

PRELIMINARY PRECAUTIONS: Before introducing new birds to the flock they should be carefully examined for disease and any showing obvious signs of ill health promptly rejected. This will, of course, lead to a loss but if this is not done the loss will be multiplied many times over. It is almost imperative to isolate new birds for at least a fortnight before allowing them to run with the original flock. During this period they should be kept under careful observation and if they show signs of disease they should be kept isolated until they have either permanently recovered or have been destroyed.

CAUSES OF CONTAMINATION: It is now known that rat fleas distribute the germs of plague and it is quite possible that they may also be responsible for some diseases of poultry, although this is not known for certain. Anyhow, it is quite clear that rats do immense damage by killing young chickens and by destroying large quantities of food. It is also quite certain that they are capable of carrying the germs of infectious diseases on their feet as well as the eggs of intestinal parasites, so the fewer rats there are about any poultry farm the better. I have already devoted a whole chapter to the extermination of rats, and this should be done whenever they become at all numerous. Infectious diseases and eggs can also be carried on the feet of coolies and visitors and this fact should not be lost sight of. Ground already contaminated by other fowls is also a fruitful source of trouble and any new poultry farm should be sited on absolutely virgin ground.

EXTERNAL PARASITES

Although it is not known to what extent parasites such as lice, fleas, and red mite are actual carriers of infectious diseases, there is no doubt that the weakness and debilitation caused by them, not to mention the constant irritation caused by their bites, has a lowering effect on health leading to a predisposition to succumb to the invasion of any disease

germs that may be about. A perfectly hard and healthy bird might successfully combat these germs, but a weak and irritated one certainly will not. It is therefore essential to keep all birds free from external parasites, and in India this is a very difficult task. The first essential is scrupulous cleanliness and constant disinfection of houses, and the second is treatment of the fowls themselves with suitable dusting powders and dust baths. If on examination birds are found to be infested with lice or other body parasites they should be immediately dusted with a powder made up as given below. Under the wings and tail feathers are the important parts but the body feathers should be ruffled back and the powder applied to the skin under them all over the body.

- 1 Part finely powdered crude phenol (carbolic acid).
- 10 Parts finely sifted slaked lime.
- 20 Parts flowers of sulphur.
- 1 Part DDT.

The DDT can be added by incorporating a tin or two, depending on the quantity of powder prepared, of any commercial brand of DDT combined with talcum powder. DDT should be used with discretion and should not be too strong. Gammexane should be avoided as it gives an unpleasant taste to both flesh and eggs.

There is a particularly formidable kind of louse which attacks young chickens and attaches itself to their heads and necks. A sharp lookout should be kept for these and all young chicks examined periodically for them. Rub their heads and necks with a mixture of turpentine and vaseline repeated until the lice disappear. This can also be alternated with the above powder in the case of adult birds but it should not be used for chicks.

Red mite is another parasite of fowls which causes debilitation by sucking the blood at night. They are only red when they are full of blood and are difficult to see when they are not full of blood as they are then white and very minute. They do not breathe through spiracles in their skin and cannot be suffocated with fine dust as other parasites can be. The best treatment is to spray the birds with "Flit" and dust them with the DDT-Talcum mixture. DDT acts by

attacking the insect's nerve centres and one minute crystal of DDT will finish off any small insect in a very short time. Red mite do not live on the bodies of the fowls but in cracks and crevices in the hen houses whence they sally forth at night to get their daily meal, so when red mite infestation takes place the houses, and especially all fine crevices, must be continually disinfected until they disappear, which will not be for some considerable time as they are very difficult to get rid of.

Another ailment due to external parasites is scaly leg, which is caused by a minute spider which burrows under the scales and is similar to the parasite causing scabies in human beings. To cure this the hen should be stood in a basin of warm water made soapy with "Lux" or carbolic soap. When the scales have been softened the loose ones should be gently removed, but no force should be used. The legs should then be smeared with sulphur ointment and the hen released. One application will not effect a cure and not less than three treatments should be given, and even more in obstinate cases. The scales removed are very infectious and should be promptly burned. This seemingly trifling ailment should not be neglected or it will soon spread throughout the flock. If one fowl is found to have scaly leg all others should be examined for it and, if necessary, treated.

INTESTINAL PARASITES

All birds and animals carry, to a more or less extent, intestinal parasites. If the bird is in a robust state of health its normal bodily functions will manage to maintain a balance between total immunity and a mild infestation which makes little or no difference to the health of the bird. However, should the birds begin to suffer ill-health from any cause the lowered bodily resistance will enable the parasites to gain the upper hand and cause further degeneration which may end in death or permanent injury, rendering that particular fowl valueless. Intestinal worms are spread by eggs which exist in the droppings of all infested fowls, so that any badly infested bird will be continually spreading eggs to be picked up by other individuals in the flock. It is therefore very important to diagnose and treat fowls infested

with intestinal parasites as soon as possible and to keep them isolated until the treatment is complete. If birds are permitted to discharge parasites on the ground, after dosage with a purge, they will merely contaminate the ground and spread the eggs more effectively to others. For this reason all birds under treatment should be isolated in special pens, apart from the others, and kept there until there is no danger of their spreading infection. All droppings from infected birds must be promptly burned.

The isolation pens should consist of a series of small compartments not less than two feet square, with a floor of wire netting two or three inches from the bottom, under which there is an easily removable sliding tray, made of galvanized iron, for droppings. The droppings will then pass through the wire netting onto the metal tray and can be easily examined and promptly burnt. The bird's feet will then not be contaminated by its own droppings. Each compartment must be completely isolated from the next by a partition which reaches right down to the bottom of the tray compartment. Before putting a fresh patient into a pen it must be thoroughly disinfected. This may seem an elaborate ritual but it is the only way of preventing communicable diseases from spreading throughout the flock. Pens should be fitted with barred fronts with bars $1\frac{1}{2}$ " apart, hinged at the top for easy access.

If there is any doubt as to the diagnosis of the complaint the bird should be opened up and a *post-mortem* examination conducted. This is especially necessary when several birds are affected simultaneously. It is better to lose one than many. In cases of doubt or serious epidemics the local veterinary surgeon or expert from the nearest Government Poultry Institute should be consulted without delay. These are general principles applying to all infectious diseases and not merely to parasitic infestation by intestinal worms.

WORMS

TAPE WORM: This is very similar to the tape worm infesting human beings and consists of white segments which continually break off and are passed in the droppings. A

single tape worm, which may be several yards long, is capable of causing severe wasting ending in death. These worms lay an immense number of eggs and a single infested bird may soon contaminate the whole flock. The head is attached to the intestine by hooks which are very difficult to dislodge and after treatment this head should be searched for in the droppings or the tape worm will very soon revive and become as dangerous as ever. Treatment should be continued until the head of the worm appears. *Symptoms*: Severe wasting, ruffled feathers, and a general drooping and unhealthy appearance. Tape worm segments in the droppings. *Treatment*: Segregation in the isolation pens and dosage, after a fast of twelve hours at least. Early morning is the best time for a dose which should be one drachm of extract of male fern followed at mid-day by a purgative of 20 to 30 grains of Epsom salts or a teaspoon of castor oil. After treatment, nourishing feed of soft mash mixed with sour milk. All sick fowls should be fed on a nourishing and easily digestible diet, of which milk should form a large part until they have recovered their strength.

ROUND WORMS: *Symptoms*: The same as for tape worm except that no white segments are to be found in the droppings. *Treatment*: Isolation as for tape worm and, after twelve hours fast, two grains of Santonin in the early morning followed by a purgative of 20 to 30 grains of Epsom salts at noon. All worms passed must be burned.

RESPIRATORY COMPLAINTS

GAPE: This is caused by a double worm in the windpipe of young chickens. The worm looks like a capital Y, the male worm much smaller than the female, being attached to the female about half way along. *Symptoms*: The chick constantly opens its beak and gasps for breath as the worms attach themselves to the inside of the windpipe. *Prevention*: As prevention is better than cure it is wise to place a piece of camphor in the drinking water of all young chicks. This is supposed to be a preventive. Chopped onions and especially garlic in the mash is also a preventive. If chicks get the gapes it means that the ground on which their coops and uns are situated is contaminated with the eggs of these worms

and they should be shifted to fresh ground and the land on which their coop originally stood should be dug up and thoroughly limed. *Treatment*: These worms can be extracted from the windpipe by stripping a feather to within about half an inch from the end, inserting the still feathered end carefully into the windpipe, twisting it round and extracting the worm or worms, which should be promptly burned. If this method fails, two horse hairs should be knotted at the ends and the loop so formed lowered into the windpipe and twisted, the operation being repeated until the worms are removed. Another way is to confine the chicks for some time in a box with one side covered with wire netting, the top of which is formed by a tightly stretched piece of muslin. On the muslin a thin layer of finely sifted slaked lime is placed, which should be gently shaken from time to time. The fine lime gets into the chick's windpipe and either kills the worms or so weakens their hold that the chick is able to get rid of them. As gapes is a difficult complaint to treat every effort should be made to prevent chicks from getting it.

COLD OR CATARRH: These complaints are caused by damp, cold, or draughty houses, sudden changes of climate, stuffy and badly ventilated houses. If the kind of houses recommended in this book are adopted this complaint is very unlikely to occur—my fowls have never suffered from it. *Symptoms*: Frequent sneezing, general debility, wheezy sounds from the throat, watering from the eyes and nose. *Treatment*: Keep the bird warm and dry, wipe the eyes and nose frequently with a weak warm solution of permanganate. Put a few drops of essence of camphor in the drinking water and feed on a nourishing diet of soft food. Roup powder may be administered by putting some in the drinking water.

ROUP: A mild form of diphtheria. Unless treatment is commenced immediately diphtheria may be caused. *Causes*: The same as for cold, contagion from other birds, general poor health. *Symptoms*: The same as for cold but more severe, gasping for breath, foul breath, difficulty in swallowing, high temperature of over 104°F. The temperature of birds is normally higher than that of human beings or large animals, being generally over 100°F. but may rise to 103°F. or 104°F. in a sitting hen. Roup is a highly contagious dis-

ease and any birds suffering from it should be immediately segregated, the other birds removed from the infected run which must be immediately disinfected, and a close watch kept for other infected birds or the whole flock may get the disease and die. Bad cases should be immediately destroyed and the bodies burnt, only comparatively mild cases being treated. But it would be wise to destroy all sick birds without delay. There are roup pills on the market and these should be administered according to the maker's directions. The birds should be kept warm and dry, fed on a nourishing soft diet, and their eyes and beaks washed with warm permanganate solution.

DIPHTHERIA : This is a highly contagious disease caused by a germ and unless promptly attended to will very soon spread throughout the flock. All birds suspected of being affected should be immediately isolated. *Symptoms:* Tightly adhering yellowish patches in an inflamed throat. Sometimes these patches appear on the mouth and face. This disease is so highly contagious and difficult to treat that the average poultry farmer will find it totally beyond his capacity to treat and the only thing to be done is to destroy and burn the birds immediately and disinfect the runs and houses from which they have been taken.

BRONCHITIS : An affection of the bronchial tubes due to similar causes as colds. *Symptoms:* Difficulty in breathing, heavy wheezy breathing, gasping and a rattle in the throat more severe than in a cold, thirst. *Treatment:* Warm and dry isolation coop, soft nourishing food, a few drops of essence of camphor in a small teaspoon of glycerine or five drops of turpentine in the same quantity of castor oil.

PNEUMONIA : *Causes:* the same as for human beings. Sudden change from the warm atmosphere of a coop or foster mother to cold air in which the birds get chilled, or sudden natural changes of temperature due to climate. *Symptoms:* General look of ill-health, coughing and gasping for breath. If the bird's chest is held to the ear ominous sounds will be heard from the lungs. *Treatment:* Birds should be isolated in a warm dry coop and fed on a soft diet consisting of mash, mixed rather soft, with milk, or bread and milk with the yolk of an egg mixed in it. The only cure is careful

nursing and protection from draughts and sudden chills.

TUBERCULOSIS: As in human beings this is caused by a germ and is just as difficult to treat. The only certain diagnosis in the case of fowls is a *post-mortem* examination. If the bird's lungs are found to have small white tubercles, often spreading to the other organs, tuberculosis should be suspected and other birds from the same breeding pen should not be used for breeding purposes. Tuberculosis also shows itself in other parts of the body such as the joints, but here diagnosis is more difficult and a Vet should be consulted. *Symptoms:* As in human beings, there is a general and progressive wasting of the body with a whitish, dry, and unhealthy looking comb, always a sign of something wrong. If the lungs are infected there may be difficulty in breathing and fever. If the birds are kept in roomy and not overcrowded houses, with plenty of open space to run about in and a proper diet they are very unlikely to contract tuberculosis. The tubercle bacillus does not thrive where there are well fed fowls with plenty of sunshine and fresh air. If these conditions prevail on the poultry farm it is unlikely that the birds have contracted tuberculosis on the farm; they must have come from a tubercular stock. In my opinion it is not worth while to try to treat tuberculous fowls as they are useless for breeding purposes and will lay no eggs. They are also not suitable for the table so the only sensible thing is to destroy them without delay before they have spread the contagion through the flock either by contact or through their eggs.

INFECTIOUS DISEASES

CHOLERA: Caused by a germ just as with humans. Due either to outside infection or to filthy conditions, bad water, or rotten food. Deficiencies in the diet are also liable to end in cholera, that is why so much emphasis has been laid on plenty of green stuff, animal protein, change of diet, fresh clean water, ample grit, lime, and exercise. Birds kept with strict regard to these essentials are very unlikely to get cholera; I have never been troubled by it. As cholera is highly contagious and can be very easily transmitted to the rest of the flock by contaminated grass, grit, or uten-

sils, the diseased bird, or birds, should be immediately isolated and destroyed. The whole run and house, or houses, should be thoroughly disinfected. A careful watch should be kept for other infected birds and these should be destroyed and their bodies burned as soon as discovered. *Symptoms*: Dark and diseased looking comb, extreme debility, and severe purging. The droppings may be either white or greenish in colour. I very much doubt whether chicken cholera can be cured, but I believe fowls can be inoculated against it in India. Application for information should be made to the nearest Government Poultry Institute or Farm. At the end of this chapter will be found the name of a book on poultry diseases which should be procured and consulted in all cases of contagious disease of a virulent nature.

ENTERITIS: Probably due to a specific microbe, but this is not certain. It is a dangerous and infectious disease which is common in England and also in some parts of India. *Symptoms*: Severe debility, shivering, and great thirst coupled with diarrhoea of a bright yellow colour. *Treatment*: As far as I know there is no successful treatment for this severe complaint and I advise immediate destruction of all birds found to be suffering from it before the disease spreads. All houses and land contaminated by sufferers must be immediately disinfected and the land dug over.

RANIKHET DISEASE, AND FOWL POX: According to the Government of India Research Station, Izatnagar, it can be controlled by routine inoculation and information as to arrangements for this should be sought from this or any other Government Poultry Institute in the neighbourhood.

TIC FEVER: This is also said to be controllable by the injection of arsenical preparations. Reference should be made to the same authorities.

COCCIDIOSIS: This is another Indian disease about which I have no information and have so far been unable to obtain any. In case of need application should be made to Government of India Institutions.

NON-INFECTIOUS DISEASES

APOPLEXY: A disease due to overfeeding or a diet too rich in starch such as rice or maize unmixed with other grains,

combined with insufficient exercise or green and animal food. *Symptoms*: Staggering due to giddiness and running backwards or flying up and falling backwards. Hens afflicted with apoplexy often fly a short distance into the air and fall down dead. On examination they will usually be found to be covered with fat. As hens afflicted with apoplexy are liable to a relapse even if temporarily cured it is better to use them for the pot.

CONGESTION OF THE LIVER: Due to improper feeding and lack of exercise. As I have mentioned before, liver complaints are almost invariably brought on by feeding fowls on dal, beans, or peas, and these should be rigorously excluded from the diet. *Symptoms*: Lethargy, loss of appetite, and over-fatness. If you are careful not to include beans or peas in the diet, give your hens plenty of exercise, and never allow them to get fat, you will not be troubled with a great many diseases which are due to these causes. *Treatment*: Much more exercise and much less food; diet should consist of hard grains of a non-starchy nature. Both rice and maize should be avoided.

INFLAMMATION OF THE LIVER: Due to the same causes as the above but leading to more acute symptoms of the same kind. *Symptoms*: To the above symptoms may be added diarrhoea. *Treatment*: More exercise and less food as above and a hard grain diet after treatment has been given. One grain pill of calomel followed by 20 to 30 grains of Epsom salts in a little warm water. Treatment should be repeated if a cure is not effected by a single dose. Young turkeys are inclined to get this disease if they are fed on a diet containing over-fattening ingredients. The treatment for them is the same. All birds suffering from liver complaints should be kept separate from the flock, in some quiet corner, until they have recovered. Hens which have had congestion of the liver after they are more than one year old are never likely to lay again.

CONSTIPATION: Due to improper food, too little exercise or water and lack of green food. *Symptoms*: General uneasiness and inability to dispose of droppings on account of obstruction of the vent. *Treatment*: Swab the vent with a clean rag dipped in weak warm permanganate solution, give

20 to 30 grains of Epsom salts or a teaspoon of castor oil. In obstinate cases an enema of warm soapy water may be necessary. Give increased exercise and plenty of green stuff with grains still covered with their outside husk, such as paddy and unhusked barley or wheat.

DIARRHOEA: Caused by bad or rotten food, lack of suitable grit, dirty and infected water or too much watery green stuff. *Symptoms:* Weakness, dejection, and watery droppings. *Treatment:* A dose of Epsom salts or castor oil to clear the intestines, followed for a few days by a diet of soft mash, milk, with chopped onions and garlic, or boiled rice and the same. Change the diet and see that all drinking and feeding vessels are scrupulously clean.

JAUNDICE: Caused by too much fattening food, chill, or lack of exercise combined with too much food. *Symptoms:* Yellowness of the skin and general look of ill-health. *Treatment:* Give purgatives like Epsom salts, castor oil, rhubarb or aloes. The last two seem to be the best. Correct the diet and be sure there is sufficient green food and clean animal protein but no fat or fattening grains like husked rice or maize.

PIP: A dry spot on the tongue caused by the bird breathing through the mouth on account of some obstruction in the nostrils. *Treatment:* Wash the nostrils with a weak warm permanganate solution and soften the spot on the tongue with equal parts of glycerine and water applied with a small swab of cotton wool on a match stick. Do not try to remove the spot on the tongue but continue the treatment until it disappears naturally. Keep the nostrils free by constant bathing.

EXTERNAL COMPLAINTS

RHEUMATISM: Due to cold damp houses or runs, abrupt change in the weather, or a continued cold wet spell. *Symptoms:* Hot and swollen joints, pain and difficulty in walking. *Treatment:* Keep in warm dry coop and rub the joints with a liniment such as "Elliman's Embrocation" or "Sloan's Liniment"; in obstinate cases paint with iodine. As this is a complaint of elderly birds, unless they are valu-

able cocks and needed for breeding purposes they should be used for the table as they are usually of no further use.

CRAMP: Due to the same causes as rheumatism. *Symptoms:* clenched claws and inability to walk. As this is an ailment of young chicks as well as elderly fowls they are well worth careful treatment. *Treatment:* Remove to a dry warm coop raised off the ground, massage the feet with warm camphorated oil or some other liniment several times per day, but do not try to open the claws by force. Feed on warm, soft, nourishing diet with plenty of fresh or sour milk, which is good for all sick fowls.

LEG WEAKNESS: Generally found in young chicks and is due to too rapid growth with an insufficiency of lime and other minerals as well as lack of suitable protein foods. *Symptoms:* Staggering, inability to stand, and flapping of wings in the effort to support the body. In adult birds this may be due to over-fatness or weakness at the laying stage. *Treatment:* Correct the diet, give plenty of green bone, lime, and proteins in the food. In young chicks see that all the essential ingredients are present in the diet. Green food, onions or garlic, lime (green bone or crushed shell), grit, and animal protein of some kind. To full grown birds give a purgative as well as adjusting the diet and environment.

BUMBLE FOOT: Probably caused by badly shaped or rough perches, hard, uneven, or rocky ground. *Symptoms:* Lameness, hopping on one foot. Bumble foot commences as a kind of corn on the sole of the foot which, if neglected, may develop into an abscess. *Treatment:* If when first discovered it is in an early stage it can be treated by painting with a saturated solution of salicylic acid in methylated spirit. This causes the outer skin to become white and soft and it can be scraped off or pared away with a sharp knife. Continue the treatment until the corn disappears. Acetic acid may also be used in the same way. If the corn develops into an abscess this should be opened with a sharp sterilized knife and the wound washed with warm permanganate solution. It can then have a dressing of "Germoline" or other antiseptic ointment held in place with a bandage until the wound has healed. If necessary

the operation should be repeated. The bird should be kept in a separate coop away from the others until the bandage can be removed and the feed should be reduced to compensate for lack of exercise. Diet should be of mash with chopped onion, fresh chopped lean meat, and barley or jowar meal moistened with milk.

DISORDERS OF THE VENT

EGG BOUND: This is caused by the inability of a hen to pass her eggs, either because she is too fat or on account of internal weakness. *Symptoms:* Restlessness, running aimlessly about between efforts to lay. If something is not done at once the hen will die. *Treatment:* The fore-finger should be liberally smeared with vaseline and the inside of the vent as far as the obstructing egg carefully lubricated. An effort should then be made to eject the egg by gentle massage, care being taken not to break the egg inside the hen because this will probably cause death. If the egg is not released the hen will die anyhow. Some books advise holding the hen over a vessel of boiling water for quarter of an hour to soften the vent, and in obstinate cases this can be tried. After the release of the egg an opening dose should be given. Once the egg has been passed there is usually no further trouble. As this is usually a complaint of young pullets it is well worth doing everything possible to save their lives, but no force or roughness should be used.

GLEET: Inflammation of the vent. The cause is supposed to be the breaking of an egg within the ovarian duct in the effort of laying. This may be so or there may be some other cause. *Symptoms:* Inflamed and offensive vent. *Treatment:* The vent should be carefully bathed with a warm solution of permanganate or some other non-irritating disinfectant, and any crusts softened and carefully removed. The treatment should be continued until the bird is cured and she should be isolated until there is no further inflammation. This is necessary because the condition is passed on from one hen to another by the cock which has become infected from her. If a cock is suspected of spreading the disease he should be isolated until cured. After the vent of

the infected hen has been carefully cleaned it should be dressed with some soft ointment such as "Burnol" or carbolated vaseline. Diet should be soft mash with chopped onions or bread and milk. If considered necessary give a purgative.

SOFT EGGS: Probably due to lack of lime in the diet. As some parts of India are notoriously deficient in lime this should be suspected and ample lime provided. If the diet obviously contains sufficient lime then the cause may be an over-stimulating diet, causing the hen to lay her egg before it has had time to get covered with lime, or it may be due to inflammation or some other internal derangement. Correct the diet, supply sufficient lime and reduce stimulating foods such as animal protein. Give a purge of Epsom salts or castor oil. Feed for a few days on boiled rice and milk or stale bread soaked in milk.

PROTRUSION OF THE OVIDUCT: *Cause:* Strain of trying to lay too large an egg or general debility. *Treatment:* Wash the exposed parts in a mild warm disinfectant such as permanganate, weak "Dettol," or "Izal." Gently but firmly press the protruded part back with a warm moist soft handkerchief and give an opening dose of castor oil or Epsom salts. If the oviduct is again prolapsed the case is probably incurable and the only thing is to use the bird for the pot.

SKIN DISEASES DUE TO EXTERNAL MICRO-ORGANISMS

GREGARINOSIS: An infectious disease caused by a minute organism which burrows under the skin of the comb, eyes, throat and nose, sometimes also invading the mouth and internal organs. *Symptoms:* Pale rough comb, ruffled and dull plumage, general weakness and lack of control. Scabs form on the comb and the eyes become inflamed with a copious discharge. If the mouth, throat, and intestines are invaded there may be diarrhoea and discharge from the throat. *Treatment:* Immediate isolation in mild cases, with the application of oxide of mercury ointment or sulphur ointment, combined with a nourishing diet of boiled rice and milk or soft mash mixed with sour milk. This disease is

communicable to other birds and farm animals generally so all scabs removed and the carcasses of all dead fowls should be immediately burned. If the mouth and throat are affected treatment will be futile and the bird should be destroyed and burnt without delay, all houses and coops occupied by sick fowls being promptly treated with a strong solution of some powerful disinfectant.

FAVUS: This is another skin disease caused this time by a fungus. *Symptoms:* Pale scabs on the comb, face, and neck, signs of discomfort and restlessness. As in all diseases, the longer treatment is postponed the harder the treatment becomes. *Treatment:* Wash the affected parts with vinegar or a dilute solution of acetic acid, and then apply sulphur or mercury oxide ointment until the symptoms disappear. During the treatment isolate the bird and disinfect hen houses as above.

MISCELLANEOUS AILMENTS

CROP-BOUND: Accumulation of fibrous material in the crop or inability to pass food from the crop to the stomach. This condition is often found in young ducklings if ample water is not supplied at feeding time. The sticky mash accumulates in the crop where it forms a hard ball which the duckling is unable to get rid of. In the case of very young ducklings there is practically nothing that can be done and the little birds usually die within a few hours. Water passed into the mouth by means of a teaspoon followed by gentle massage may be tried. *Symptoms:* Distended and pendulous crop in which it is possible to feel a hard ball of food. *Treatment:* Give a dose of Epsom salts or other purgative. Pour a teaspoon of oil, or if this is not available water, down the throat and knead the crop gently, endeavouring to soften the hard mass and incorporate the oil in it. This may take a long time so the treatment must be persevered with, additional oil being administered if necessary. If the lump is successfully softened it will pass to the stomach without further trouble. The bird should be isolated in a separate coop and fed on a hard grain diet without any mash for a few days. In obstinate cases involving a valuable bird an operation will have to be resorted to. An incision is made with

a very sharp pointed knife in the upper part of the crop, sufficiently large to admit a small teaspoon, with which the crop contents are then gently removed. Wash out the now empty crop with a weak warm solution of permanganate and sew up the wound with a sterilized surgical needle and surgical silk. The crop will be found to have two skins or layers, an outer and an inner. First suture (sew) the inner membrane (skin) and then the outer, being sure to draw both edges firmly together, with stitches about one quarter of an inch apart. Apply a little "Germoline" or similar ointment to the outside of the wound and keep the bird in a separate coop until the wound has healed. In doing any operation on a bird or in dressing wounds all antiseptic precautions must be observed just as carefully as in operating on human beings. All instruments, such as knives and needles, must be boiled for at least five minutes and the hands carefully washed before touching the bird or operational material. Birds should be very gently handled and not frightened. No operation or dressing should be undertaken until the bird has ceased to struggle. Feed the birds on boiled rice or bread and milk mixed with green leaves and very finely chopped onion for a week.

FEATHER EATING: Birds which are closely confined, and sometimes others, get into a habit of plucking out their own or their neighbours' feathers and eating them. This is caused by some deficiency in the diet or lack of occupation and exercise. *Symptoms:* No possible mistake can be made about the symptoms of this disease, if disease it can be called, because if something is not done the birds will become entirely denuded of feathers beginning with the small ones of the breast and round the vent. *Treatment:* Isolate the affected birds and put them into a run where they can get plenty of exercise. If necessary create exercise for them by compelling them to jump for a bunch of green leaves, for which mustard leaves are excellent. Feed them on a mash of the ordinary composition containing a teaspoon of flowers of sulphur. Attend to all matters such as ample supply of grit, lime, fresh vegetables, and protein food and clean fresh water. Sliced green bone should be included in the diet. If the plucked parts are raw and inflamed rub them with sul-

phur ointment and see that the birds are free from lice or other parasites.

EGG-EATING: If birds have plenty of range and a correct diet they are very unlikely to eat their own eggs, but this vice, if once commenced, is not easy to cure. Fill a blown egg with mixed mustard and place it in the coop occupied by the egg-eater. If she eats it she may be cured. If she does not the only thing to do is to use her for the pot as she will destroy more eggs than she is worth.

This chapter contains such a formidable list of poultry diseases that it may make some people hesitate before commencing a poultry yard or farm. However, poultry are like human beings, liable to a large variety of diseases although for the most part they never suffer from any of them, provided they are properly housed with plenty of ventilation, light and air, and are correctly fed. As I have so often emphasized in previous chapters, there are certain essentials in a fowl's diet without a regular supply of which health is not possible. These are grit, lime, fresh clean water, animal protein, and plenty of fresh green stuff of some kind. If your fowls are not overcrowded, given plenty of exercise in runs of ample size on dry well-drained soil, and protected from infection from external sources, they will remain healthy from one year's end to another. It is overcrowding in filthy houses with totally inadequate runs on wet and water-logged clay soils, combined with incorrect, and very often, rotten food, which are the causes of disease in poultry of all kinds. It may seem a great waste of time and trouble to clean out poultry houses every day, or at least several times a week, disinfect them twice a month and go into all the tedious routine of supplying proper dust baths, lime, grit and so forth. But believe me, it is much cheaper and more satisfactory than having to perpetually treat sick and ailing poultry which give no return in eggs and no other satisfaction either.

In treating sick birds they must be gently handled and on no account roughly treated or frightened. The domestic fowl is a sensible bird and very soon realizes that she is being helped and not injured and will patiently undergo treatment or, in fact, quite serious operations with admirable patience

and fortitude, provided she is handled in a sympathetic and humane manner.

I have given an exhaustive list of diseases and treatments not because your fowls are ever likely to suffer from them all or even a considerable number of them but in order that may be, and so will not be at a loss as to what to do in an emergency. I hope that by following the directions given in the various chapters of this book you will never be seriously troubled by poultry diseases at all.

MOULTING

As every bird moults its feathers once a year this can hardly be called a disease but, all the same, at this period of their lives fowls are in a somewhat abnormal state of health and require special attention. Chickens get their first feathers towards the end of their first year, in England in about September, and have their first moult in September of the following year. The moult takes from about six weeks to two months. Each year the birds moult later and the process takes longer. As during the moult they lay no eggs it is best to dispose of them just before their second moult or use them for the table at this period. While moulting, as they lay no eggs, fowls need less protein food but should be given a good nourishing feed of warm, not hot, mash once a day and a feed of hard grain at the other feeding time. As feathers contain a good deal of sulphur and the soil and feed contain very little it is advisable to incorporate a tablespoon of flowers of sulphur in their mash, and a lump of solid sulphur in their drinking trough all the year round will do no harm. At the time of the moult a sharp lookout should be maintained for symptoms of disease as this is the time they are most likely to pick up any disease that may be prevalent.

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